Basin-Specific Feasibility Studies

Everglades Protection Area Tributary Basins

Preliminary Alternative Combinations

For the ECP Basins

Peer Review

Submitted to

South Florida Water Management District

December 31, 2001

Contract No. C-E023

Project No. 29042

In Association With

December 31, 2001

Ms. Tracey Piccone, P.E.
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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies
Preliminary Alternative Combinations for the ECP Basins
Peer Review
B&McD Project No. 29042

Dear Ms. Piccone:

Burns & McDonnell, in association with Nova Consulting, Inc, is pleased to submit this Peer Review of the District's October 30, 2001 *Preliminary Alternative Combinations for the ECP Basins*. This document comprises the Final submittal required under Subtask 3.2 of the Statement of Work (Appendix "C" to Contract C-E023).

All District comments received on the November 30,2001 Draft of this *Peer Review* have been addressed herein. The content of this *Peer Review* has been expanded to include evaluation of the additional alternatives at STA-1E associated with the potential diversion of discharges from the Acme Improvement District Basin B, as requested in your communication of December 19, 2001. Those alternatives are included as Alternatives 4 and 5 for STA-1E, and Alternative 3 for STA-1W. In addition, we have expanded the evaluation and discussion of Alternative 3 for STA-2.

We gratefully acknowledge the District's contributions to the successful completion of this task, and look forward to continuation of our services under Contract C-E023 through the conduct of Task 4. Please feel free to contact me at 816-822-3099 or electronically (gmiller@burnsmcd.com) should you have any questions or desire additional information.

Sincerely,

Galen E. Miller, P.E.
Associate Vice President

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Basin-Specific Feasibility Studies
Everglades Protection Area Tributary Basins

Preliminary Alternative Combinations for the ECP Basins

PEER REVIEW

December 31, 2001

INDEX AND CERTIFICATION

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Certification

I hereby certify, as a Professional Engineer in the State of Florida, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the South Florida Water Management District or others without specific verification or adaptation by the Engineer. This certification is provided in accordance with the Florida Board of Professional Engineers' Rule on Certification under Chapter 21H-29.

Galen E. Miller, P.E.
Date:
(Reproductions are not valid unless signed, dated and embossed with Engineer's seal)

EXECUTIVE SUMMARY

The long-term Everglades water quality objective is to implement the optimal combination of source controls, STAs, Advanced Treatment Technologies (ATTs), and/or regulatory programs to ensure that all waters discharged to the Everglades Protection Area (EPA) achieve water quality goals by December 31, 2006. Permit applications and integrated water quality plans are to be submitted to the Florida Department of Environmental Protection (FDEP) by December 31, 2003. To meet these objectives and time frames, the District is conducting basin-specific feasibility studies that will integrate information from research, regulation, and planning studies to provide information necessary to allow policy makers to determine the optimal combination of source controls and basin-scale treatment to meet the final water quality objectives.

The results of these studies are not intended to define the final arrangement, location and character of the final strategy for each basin. Rather, the purpose of the evaluation is to develop the information necessary for informed decision-making by the District's Board of Governors and the Florida Legislature relative to funding, final implementation schedule, rulemaking, and those other policy-level determinations necessary to permit the State of Florida and the South Florida Water Management District to proceed to fulfillment of their obligations under the federal Everglades Settlement Agreement (Case No. 88-1886-CIV-HOEVELER) and Florida's 1994 Everglades Forever Act (F.S. 373.4592).

The District has compiled basin-specific characteristics and developed preliminary alternative combinations of point source control, basin-level, and regional water quality treatment solutions for each of the ECP basins. Preliminary combinations of alternatives for the basins tributary to the various stormwater treatment areas constructed under the ECP have been disseminated by the District in the October 30, 2001 Final Draft of *Water Quality Improvement Strategies for the Everglades, Preliminary Alternative Combinations for the ECP Basins*.

This document present the results of a Peer Review of the *Preliminary Alternative Combinations for the ECP Basins* conducted by Burns & McDonnell Engineering Company, Inc., in association with Nova Consulting, Inc. The conduct of the Burns & McDonnell peer review of the *Preliminary Alternative Combinations for the ECP Basins* and preparation of this document was authorized by the District's Board of Governors through its approval of Contract C-E023 at its September, 2001 meeting.

The principal objective in the conduct of this Peer Review is to identify recommended refinements to the alternatives proposed by the District for each of the STA-specific tributary basins, with particular emphasis on identification of any potential "fatal flaws" or possible impracticality in the implementation of any proposed alternative combination. An additional objective is to identify and propose other possible alternative combinations for the District's consideration.

The detailed evaluation of alternatives under Task 4 of Contract C-E023 will employ the most recent version of the DMSTA (Dynamic Model for Stormwater Treatment Areas) analytical tool (Walker and Kadlec). For this preliminary review of proposed alternative combinations, it is considered desirable to conduct preliminary analyses in advance of that full evaluation to assess the potential overall performance of a given STA under any given alternative. These analyses are not meant to form final projections of treatment performance, but only to assess the degree to which marked improvement from baseline conditions might be anticipated, and to serve as a preliminary screening of proposed alternatives.

These preliminary analyses employ the first-order decay model with atmospheric and groundwater interactions used in previous STA designs for evaluation of the treatment performance of wetland treatment systems. The general limitations of this "steady-state" model have been recognized, hence the intent to employ the DMSTA analytical tool in the more detailed evaluations. Additional information on the steady-state model used in this evaluation is included in Section 2. Section 2 also identifies the analytical method used to estimate total phosphorus reduction in basins or reservoirs "upstream" of any given treatment area.

Section 2 also defines the parameters employed in the analysis for the various wetland types (e.g., STA, SAV, and PSTA) and for basins and reservoirs. The parameters used herein have not been fully calibrated, nor has the selection of those parameters been subjected to peer review. As a result, these preliminary analyses must be recognized to be but a general indication of the performance of any given combination of alternatives. **All estimates of treatment performance presented herein should not be taken as fully representative of true performance. Their use as employed herein is to simply serve in preliminary screening of any combination of alternatives.**

As a part of this evaluation, the estimated STA inflows and outflows presented in the District's May 2001 Baseline Data for the Basin-Specific Feasibility Studies have been revisited. In some instances, certain adjustments have been made to estimated inflow volumes and total phosphorus (TP) loads. In each instance, the projected long-term mean outflow volumes and TP loads and concentrations have been adjusted using the methods discussed in Section 2. The baseline performance of the various STAs of the Everglades Construction Project considered in this evaluation is summarized in Table ES-1.

Table ES-1. Preliminary Estimates of Baseline Inflows and Outflows

Location	Estimated Average Annual Inflow			Estimated Average Annual Outflow		
	Volume (acre-feet)	TP Load (tonnes)	TP Conc. (ppb)	Volume (acre-feet)	TP Load (tonnes)	TP Conc. (ppb)
STA-1E	133,473	28.95	176	139,003	4.64	27
STA-1W	160,335	27.40	139	166,317	5.37	26
STA-2	233,473	29.08	100	217,440	8.58	32
STA-3/4	660,889	72.02	88	549,179	19.40	29
STA-5	91,400	21.69	192	81,152	2.71	27
STA-6	58,170	10.26	143	52,480	1.77	27
Total	**1,337,740**	**189.40**	**115**	**1,205,571**	**42.47**	**29**

Each of the alternatives proposed in the District's October 30, 2001 Final Draft of *Water Quality Improvement Strategies for the Everglades, Preliminary Alternative Combinations for the ECP Basins* have been evaluated, as have a number of additional alternatives proposed for consideration.

A summary of those alternatives, including the comparative estimates of their relative performance in reducing total phosphorus loads discharged to the EPA, is presented in Table ES-2.

Table ES-2. Summary of Alternatives Considered

Location	Alternative	Description	Remarks	Estimated Average Annual Inflow			Estimated Average Annual Outflow		
				Volume (acre-feet)	TP Load (tonnes)	TP Conc. (ppb)	Volume (acre-feet)	TP Load (tonnes)	TP Conc. (ppb)
STA-1E	**Baseline**	Current design, considered as emergent macrophyte STA	TP Reduction in Distribution Cells considered (typ all alts.)	133,473**	28.95	176	139,003	4.64	27
	1	Integration with C-51 and Southern L-8 CERP Reservoir	No current basis for adjustment of predicted loading	?	?	?	?	?	?
	2	Optimize Performance within Existing Footprint	Approx. 58% of area converted to SAV	133,473**	28.95	176	139,003	2.68	16
	3	Expand to Obtain Lowest Sustainable TP Concentration	Alternative 2 in place,;2,350-acre expansion all SAV	133,473**	28.95	176	141,112	2.17	12
	4, Case 1*	ACME Basin B discharges directed to expanded STA-1E	Alternative 2 in place,; 1,102-acre expansion all SAV	164,972**	32.61	160	170,563	3.16	15
	4, Case 2*	As for Case 1, but all S-5A Basin inflows to STA-1W	407-acre expansion of STA-1E; requires STA-1W Alt. 3 concurrent	142,420**	28.91	165	147,388	2.73	15
	5*	ACME Basin B discharges to C-51W, GKK rock pit	100-acre reservoir; 1,145 acre "new" STA for diverted flows	31,499**	6.38	164	32,526	0.60	15
	5*	ACME Basin B discharges to C-51W, GKK rock pit	STA-1E as for Alt. 2, no expansion, after diversion to "new" STA	133,331**	26.23	160	138,023	2.60	15
STA-1W	**Baseline**	Current design, considered as emergent macrophyte STA	SAV in Cells 4 and 5B considered part of Alternative 2	160,335	27.40	139	166,317	5.37	26
	1	Integration with C-51 and Southern L-8 CERP Reservoir	Inflows reduced for trib area reduction of 1,800 acres	157,455	26.91	139	163,437	5.16	26
	2	Optimize Performance within Existing Footprint	Cells 3, 4 and 5B converted to SAV	160,335	27.40	139	166,317	3.18	15
	3*	Divert STA-1E inflows from S-5A Basin to STA-1W	Companion project to STA-1E Alt. 4, Case 2; 1,500 acre expansion	182,887	31.10	138	190,121	3.52	15
STA-2	**Baseline**	Current design, considered as emergent macrophyte STA	Present SAV in Cell 3 considered part of Alternative 2	233,473	29.08	100	217,440	8.58	32
	1	Integration with EAA Storage Reservoir CERP Project	STA-2 inflows, 70k ac-ft/yr Lake releases all passed through Comp. B	303,473**	35.47	95	264,999	9.23	28
	2, Case 1	Optimize Performance within Existing Footprint	60% of area converted to SAV; no Reservoir influence considered	233,473	29.08	100	217,440	4.93	18
	2, Case 2	Optimize Performance within Existing Footprint	As for Case 1, but Reservoir influence	303,473**	35.47	95	264,999	6.00	18
	3	Chemical Treatment Facility	See text for recommendations; post-STA, off-site residuals disposal	233,473	29.08	100	?	?	?
STA-3/4	**Baseline**	Current design, considered as emergent macrophyte STA	Deep seepage losses along Supply and Inflow canals considered	660,889	72.02	88	549,179	19.40	29
	1	Integration with EAA Storage Reservoir CERP Project	Estimated inflows from Restudy analysis for Alt. D13-R	697,200	63.80	74	638,493	22.59	29
	2, Case 1	Optimize Performance within Existing Footprint	Cells 1B, 2B and part of Cell 3 converted to SAV	660,889	72.02	88	549,179	12.11	18
	2, Case 2	Optimize Performance within Existing Footprint	As for Case 1, but with EAA Reservoir influence as for Alternative 1	697,200	63.80	74	638,493	14.81	19
	3*	Expansion, fourth flow path in parallel	20,347-acre expansion, entire STA emergent macrophyte, with Alt. 1	697,200	63.80	74	587,759	10.85	15
	4*	Expansion in Series	10,000-acre SAV expansion downstream of Alt. 2 Case 2	697,200	63.80	74	613,558	11.34	15
	5*	Expansion, add flow path in parallel, with SAV & Reservoir	9,800-acre expansion as emergent macrophyte, with Alt. 2 Case 2	697,200	63.80	74	614,058	11.34	15
	6*	Distributed EAA Reservoir	Alt. 2, Case 2, inflows adjusted for STA-2 Alt. 1, STA-5&6 Alt. 4	537,200	49.16	74	478,493	9.06	15
STA-5&6	**Baseline**	Both combined, considered all as emergent macrophyte STA	Includes STA-5, STA-6 Section 1 and 1,400-acre STA-6 Section 2	149,570	31.95	173	133,632	4.48	27
	1, Case 1	Integration with EAA Storage Reservoir CERP Project	All inflows to Comp. C; TP red. in Reservoir; no STA-6 Section 2	135,170**	30.17	181	98,067	2.34	19
	1, Case 2	Integration with EAA Storage Reservoir CERP Project	All inflows to Comp. C; TP red. in Reservoir; with STA-6 Section 2	135,170**	30.17	181	98,067	1.91	16
	2, Case 1	Optimize Performance within Existing Footprint	As for baseline, 59% of total treatment area converted to SAV	149,570	31.95	173	119,232	2.03	14
	2, Case 2	Optimize Performance within Existing Footprint	As for Alt. 1, Case 2, with 59% of total area converted to SAV	135,170**	30.17	181	98,037	1.49	12
	3	Expand Footprint of STA-5	1,060 acre expansion, with 47% SAV; STA-6 as for Alt. 2 Case 2	135,170	30.17	181	116,589	1.87	13
	4*	Full Integration with CERP Reservoir	Add 90k ac-ft/yr Lake releases to Comp. B, 1,700 ac. STA-6 Sec. 2	225,170**	37.61	135	187,489	3.54	15

Notes:
(1) Alternatives shown with a single asterisk (*) are additional alternatives proposed for consideration not originally listed in the District's October 30, 2001 Final Draft *Preliminary Alternative Combinations for the ECP Basins*.
(2) Inflow volumes (and associated inflow loads) shown with a double asterisk (**) are computed as the inflow to a reservoir or basin upstream of the STA, with TP reduction in the basin considered in the analysis.
(3) It is recommended that, <u>at a minimum</u>, alternatives listed in **bold type** be carried forward for more detailed analysis and evaluation under Task 4 of Contract C-E023.

As is apparent from review of the information in Table ES-3, there exists a wide variety of possible alternative combinations for the ECP basins. Each of those alternatives can be developed in more detail in subsequent analyses. Note 3 following Table ES-2 identifies those alternatives which, at a minimum, should in our opinion be carried forward to the next phase in completion of the Basin-Specific Feasibility Studies.

It will be necessary to recognize in that next phase that the ECP basins are not truly independent hydrologic units. The degree of interdependence and connectivity now existing in those basins will be further increased upon completion of the Comprehensive Everglades Restoration Plan. The suite of alternatives to be considered must recognize that interdependence, and the evaluation should include at least one set of alternatives developed on that basis. An example of at least one such combination of the various basin alternatives is summarized in Table ES-3.

Table ES-3. Example Regional Combination of ECP Basin Alternatives

Basin (STA)	**Altern.**	**Baseline Conditions Ave. Ann. Discharge**			**Alternative Combination Ave. Ann. Discharge**		
		Volume (ac-ft)	**TP Load (tonnes)**	**Conc. (ppb)**	**Volume (ac-ft)**	**TP Load (tonnes)**	**Conc. (ppb)**
1E	4	139,003	4.64	27	170,563	3.16	15
ACME		31,499	3.66	94	0	0	---
1W	2	166,317	5.37	26	166,317	3.18	15
2	2, Case 2	217,440	8.58	32	264,999	6.00	18
3/4	6	549,179	19.40	29	478,493	9.06	15
5	4	81,152	2.71	27	114,173	2.15	15
6	4	52,480	1.77	27	73,316	1.39	15
Total		**1,237,070**	**46.13**	**30**	**1,267,861**	**24.94**	**16**

The Acme Improvement District's Basin "B" is not presently tributary to the ECP, but is included in the listing in response to the District's December 19, 2001 request for an evaluation and peer review of two options for addressing current discharges from that basin to the Loxahatchee National Wildlife Refuge.

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1. INTRODUCTION

Florida's 1994 Everglades Forever Act (Act) establishes both interim and long-term water quality goals to achieve restoration and protection of the Everglades Protection Area (EPA). The District, in partnership with other agencies and private landowners, is aggressively and successfully achieving these interim milestones. The District has constructed four Stormwater Treatment Areas (STAs) totaling almost 20,000 acres, and has just begun construction of the largest one, STA-3/4, with more than 17,000 acres. In addition, the Corps of Engineers is constructing the 5,500-acre STA-1 East. The STAs, coupled with on-farm Best Management Practices (BMPs), are designed to reduce the total phosphorus (TP) concentration in runoff from approximately 150 ppb to an interim target of 50 ppb. EAA landowners have implemented BMPs that have reduced phosphorus loads by more than 50% over the last six years. Concurrent with implementation of the Everglades Construction Project (ECP), the District is implementing the Everglades Stormwater Program (ESP) to address the water quality issues associated with discharges from the remaining non-ECP Everglades tributary basins. Also concurrent with these activities, the District and other groups are conducting water quality research and ecosystem-wide planning, and implementing regulatory programs to ensure a sound scientific foundation for decision-making.

The long-term Everglades water quality objective is to implement the optimal combination of source controls, STAs, Advanced Treatment Technologies (ATTs), and/or regulatory programs to ensure that all waters discharged to the Everglades Protection Area (EPA) achieve water quality goals by December 31, 2006. Permit applications and integrated water quality plans are to be submitted to the Florida Department of Environmental Protection (FDEP) by December 31, 2003. To meet these objectives and time frames, the District is conducting basin-specific feasibility studies that will integrate information from research, regulation, and planning studies to provide information necessary to allow policy makers to determine the optimal combination of source controls and basin-scale treatment to meet the final water quality objectives.

The goal of the basin-specific feasibility studies is to integrate research, planning and other available information into viable water quality improvement strategies to ensure that all waters discharged into the EPA achieve water quality goals. Of the sixteen basins that discharge into the EPA, the basin-specific feasibility studies will identify and evaluate alternative combinations of source control and basin-scale treatment for fourteen hydrologic basins – eight basins covered by the Everglades Construction Project (ECP) and six basins covered by the Everglades Stormwater Program (ESP). The remaining two ESP basins (C-111 Basin and Boynton Farms Basin) will be addressed through other District and Federal programs.

Basin-specific feasibility studies for the eight basins covered by the ECP will be prepared by Burns & McDonnell under the District's Contract No. C-E023. Basin-specific feasibility studies for the six basins covered by the ESP will be prepared by Brown & Caldwell under the District's Contract No. C-E024.

As the ECP basins all discharge to stormwater treatment areas (STAs), the evaluations and feasibility studies prepared under Contract C-E023 will be STA-specific. Feasibility studies will be prepared for each of the STAs (e.g., STA-1E, STA-1W, STA-2, STA-3/4, STA-5 and STA-6). An overview of the Everglades Construction Project indicating the general location and extent of those various STAs is presented in Figure 1.

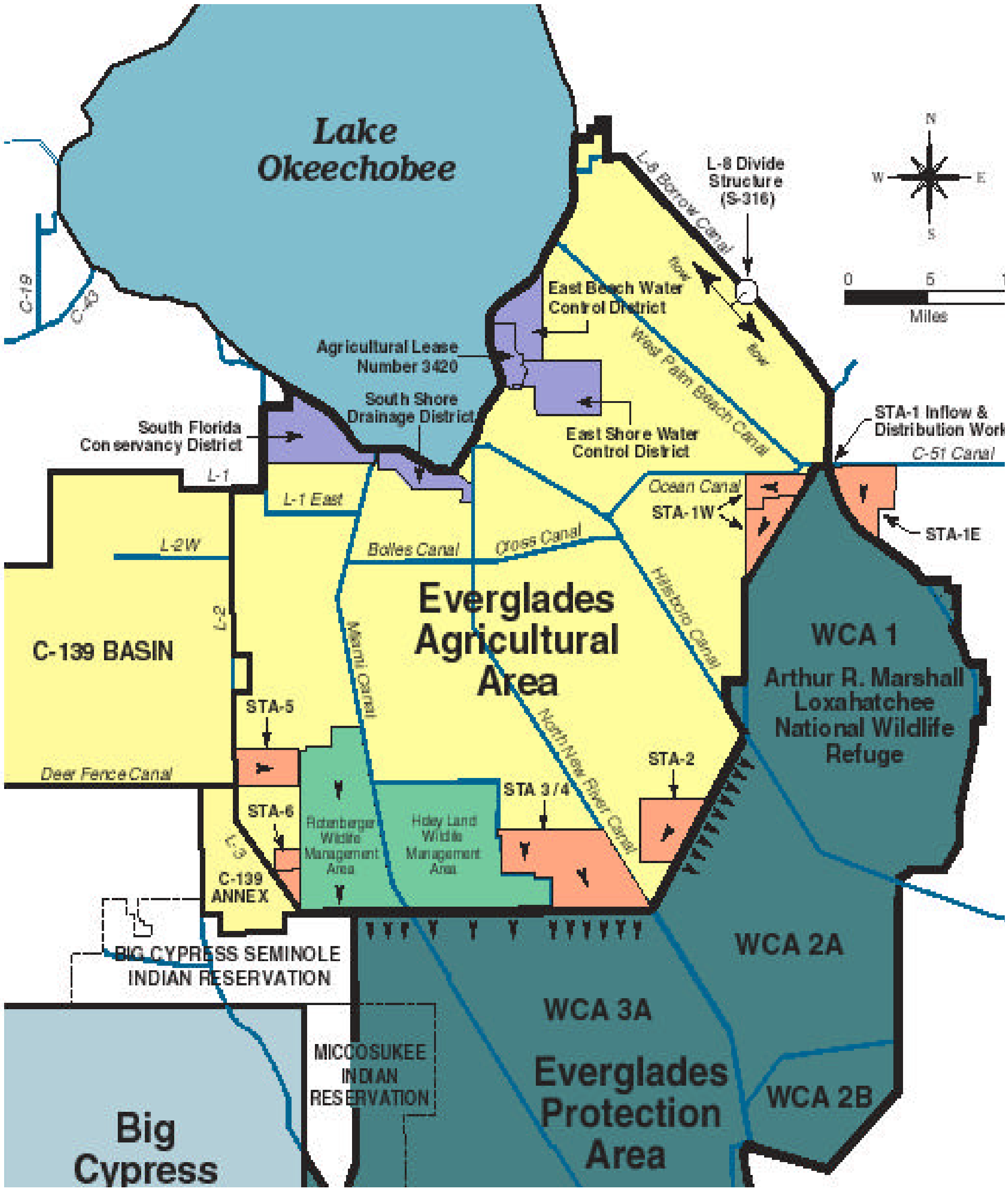


Figure 1. Overview of Everglades Construction Project

The results of these studies are not intended to define the final arrangement, location and character of the final strategy for each basin. Rather, the purpose of the evaluation is to develop the information necessary for informed decision-making by the District's Board of Governors and the Florida Legislature relative to funding, final implementation schedule, rulemaking, and those other policy-level determinations necessary to permit the State of Florida and the South Florida Water Management District to proceed to fulfillment of their obligations under the federal Everglades Settlement Agreement (Case No. 88-1886-CIV-HOEVELER) and Florida's 1994 Everglades Forever Act (F.S. 373.4592).

The District has compiled basin-specific characteristics and developed preliminary alternative combinations of point source control, basin-level, and regional water quality treatment solutions for each of the ECP basins. In preparing these alternative combinations, the District has used the baseline set of flow and water quality data, BMP research, STA optimization research, advanced treatment technologies research, and available data from other ongoing research activities. The District has considered the Comprehensive Everglades Restoration Plan (CERP, formerly known as the Restudy), Critical Restoration projects, and basin-specific water quality programs in formulating alternative combinations of water quality solutions. The District is also utilizing external review teams to assist in preparing the preliminary alternative combinations of water quality solutions.

Preliminary combinations of alternatives for the basins tributary to the various stormwater treatment areas constructed under the ECP have been disseminated by the District in the October 30, 2001 Final Draft of *Water Quality Improvement Strategies for the Everglades, Preliminary Alternative Combinations for the ECP Basins*. That document has been posted by the District on the District's website,

http://www.sfwmd.gov/org/erd/bsfboard/bsfsboard.htm

It is the District's intent that stakeholders be involved throughout the development and evaluation of alternatives; a concerted effort will be made with the stakeholders in each basin to identify the most viable of alternatives prior to conducting the evaluation of alternatives. Stakeholder involvement will be garnered through interactive development of the basin alternatives and updates during the evaluation process. The District's STA Design Review Staff Meetings have been the central forum for discussion of the ECP basin alternatives. Meeting dates and times are posted on the District's website,

http://www.sfwmd.gov/gover/3_mtgcalndr.html

1.1. Review Objective

The objective in the conduct of this Peer Review is to identify recommended refinements to the alternatives proposed by the District for each of the STA-specific tributary basins, with particular emphasis on identification of any potential "fatal flaws" or possible impracticality in the implementation of any proposed alternative combination.

1.2. Authorization

The conduct of the Burns & McDonnell peer review of the *Preliminary Alternative Combinations for the ECP Basins* and preparation of this document was authorized by the District's Board of Governors through its approval of Contract C-E023 at its September, 2001 meeting. This document comprises the deliverable required under Task 3 as it is defined in Exhibit "C" *Scope of Services* attached to that contract.

2. GENERAL

The various alternative combinations of water quality improvement strategies presented in the District's draft document include certain recurring themes. The most prevalent of those themes include:

- Integration with CERP projects.
- Optimizing performance within existing STAs through conversion of portions of the existing treatment areas to vegetative communities dominated by SAV (Submerged Aquatic Vegetation) and periphyton (PSTA, or Periphyton Stormwater Treatment Areas).

The following sections provide general information on those recurring themes considered central to the conduct of this Peer Review.

2.1. Integration with CERP Projects

Table 1 is excerpted from the District's October 30, 2001 *Preliminary Alternative Combinations for the ECP Basins*, and defines those CERP projects which could influence the further development and analysis of the alternatives.

Table 1. CERP Projects That May Influence Flows and Loads in the ECP Basins

CERP Project	Completion Date	STA-1E	STA-1W	STA-2	STA-3/4	STA-5	STA-6
ACME Basin "B" (A6.3.3.6)	4/25/07						
Rotenberger WMA Operations (EE5)*	5/3/06				✓	✓	✓
Holey Land WMA Operations (DD)*	3/26/08				✓	✓	
Pump Station G-404 Modification (II3)	9/24/08				✓		✓
EAA Reservoir Ph. I (G6)	**9/16/09**			✓	✓	✓	✓
Decompartmentalization of WCA-3 (QQ6)*	10/4/10			✓	✓		✓
L-8 Basin (K Ph 1)	3/18/11	✓	✓				
C-51 & Southern L-8 Reservoir (GGG6)	3/14/14	✓	✓				
L-8 Basin ASR (K Ph 2)	10/18/18	✓	✓				
EAA Storage Reservoirs Ph. 2	9/17/14			✓	✓	✓	✓
C-51 Regional ASR (LL)	10/15/20	✓	✓				
Everglades Rain Driven Operations (H6)*	?			✓	✓		✓

Notes:
(1) CERP Projects in **Bold** were included in the initial project authorization in WRDA 2000.
(2) Completion dates taken from 7/27/2001 Update to CERP Master Implementation Schedule
(3) Projects listed with an asterisk (*) are not expected to influence the flows and phosphorus loads discharged from the ECP basins.

Additional descriptive information on the above-listed CERP projects is contained in Appendix A, taken from the CERP website, http://www.evergladesplan.org/pm/projects.

2.2. Wetland Treatment Performance Preliminary Estimates

The detailed evaluation of alternatives under Task 4 of Contract C-E023 will employ the most recent version of the DMSTA (Dynamic Model for Stormwater Treatment Areas) analytical tool (Walker and Kadlec). For this preliminary review of proposed alternative combinations, it is considered desirable to conduct preliminary analyses in advance of that full evaluation to assess the potential overall performance of a given STA under any given alternative. These analyses are not meant to form final projections of treatment performance, but only to assess the degree to which marked improvement from baseline conditions might be anticipated, and to serve as a preliminary screening of proposed alternatives.

These preliminary analyses employ the first-order decay model with atmospheric and groundwater interactions that has formed the basis for previous STA designs. . In summary, the model is as follows:

$$(C_2-C^*)/(C_1-C^*) = (1+\alpha/q)^{-r} \qquad \alpha = (R-ET+I_i-I_o-\Delta S)$$

$$q = Q/A \qquad \gamma = R-ET+I_i+k$$

$$r = \gamma/\alpha \qquad C^* = (kC_\lambda+RC_R+I_iC_i)/(\alpha+k+\Delta S+I_o),$$

$$\text{or} \quad C^* = (kC_\lambda+RC_R+I_iC_i)/\gamma$$

where:

C_1 = average TP inflow concentration, mg/l

C_2 = average TP outflow concentration, mg/l

R = average annual rainfall, m/yr

ET = average annual evapotranspiration, m/yr

I_i = infiltration into the wetland from the groundwater, m/yr

C_R = average TP concentration in rain (wet + dry deposition), mg/l

k = effective TP first-order area-based settling rate, m/yr

A= wetland surface area, m^2

Q = average inflow, m^3/yr

q = average hydraulic loading rate, m/yr

I_o = infiltration out from the wetland to the groundwater, m/yr

ΔS = change in storage, m/yr

C_λ = the TP concentration resulting from internal loading by soils and ecological processes, mg/L

C_i = the TP concentration in the upwelling groundwater, mg/L

This model, assuming plug flow hydraulics, includes the possible effects of complex water budget considerations such as:

- Net effect of rainfall and ET
- Change in storage volume in a wetland
- Exchanges between the wetland and the groundwater

C* in this model combines the effects of internal loading, rainfall, and infiltration on the irreducible wetland outlet concentration. For example, groundwater upwelling in the wetland may carry higher TP concentrations and result in a higher background just as higher rainfall TP can result in a higher background. For this analysis, C* is assigned a value of 12 ppb. Operating experience in other large constructed wetlands for the treatment of storm runoff, in which the vegetative community consists primarily of emergent macrophytes, would not support projections of markedly lower sustainable outflow concentrations.

Application of the model for evaluation of treatment performance requires consideration of long-term mean values for each of the various parameters, as each can be expected to exhibit marked temporal variation. For this peer review and preliminary screening, estimated long-term average values of k and C^* for emergent macrophyte STAs are taken as 16 m/yr and 12 ppb, respectively (taken from the June, 2000 *Plan Formulation* document for STA-3/4, Burns & McDonnell).

2.3. Inclusion of SAV and PSTA

One alternative proposed in the October 30, 2001 Final Draft of *Preliminary Alternative Combinations for the ECP Basins* for each of the ECP basins is to optimize performance of the stormwater treatment areas through conversion of parts of the emergent macrophyte treatment area to a biological treatment system employing, in series, emergent macrophyte STA, Submerged Aquatic Vegetation (SAV), and Periphyton Stormwater Treatment Area (PSTA).

2.3.1. Preliminary Design Criteria, SAV

A report on the Supplemental Technology Standard of Comparison (STSOC) for SAV is under preparation and not available for review at this time. For this peer review and preliminary analysis, the following basic design criteria and performance estimates are assumed:

- Treatment performance k=36 m/yr, C^*=12 ppb.
- Desirable mean depth approx. 2 ft. (60 cm)
- Desirable max. depth approx. 3 ft (100 cm)
- Desirable max. velocity to prevent washout = 0.1 fps (2,700 m/day)

2.3.2. Preliminary Design Criteria, PSTA

The following estimates of preliminary design criteria for PSTA were taken or estimated from the November 7, 2001 draft *Conceptual Designs and Planning Level Cost Estimates for a Full-Scale Periphyton Stormwater Treatment Area*, CH2M Hill.

- Treatment performance k=11 m/yr, C^*=12 ppb.; the information in the draft report was not presented in this form. The mean net settling rate of 11 m/yr was back calculated from the conceptual design presented, holding C^*=12 ppb.
- Desirable mean depth approx. 1 ft. (30 cm) at the downstream control
- Desirable max. depth approx. 1 ft (30 cm) at the downstream control
- Desirable aspect ratio 1.5L:1W, as presented in the conceptual design (it should be noted that the aspect ratio in the shellrock substrate test cell on which performance estimates are based was approximately 3L:1W, or approximately 78 m:26 m).

The best performance of the PSTA tests, on which the conceptual design presented in the November 2001 document is based, was in the South Test Cell (STC-5), for a depth of 30 cm and a hydraulic loading rate (HLR) of 6 cm/day. the average velocity at the downstream end would have been 1,560 cm/day (51.2 ft/day, or 0.0006 fps). The maximum target HLR tested in any PSTA test was 12 cm/day (3,120 cm/day end velocity).

The conceptual design for a 12 ppb outflow and no bypass is comprised of three cells of 5,100 acres each (12,170 ft. wide by 18,255 ft. long), or 2,063.9 hectares. The peak HLR for that configuration is shown as 101 cm/day; the average HLR is 9 cm/day. The peak end velocity under maximum loading conditions for a depth of 30 cm would be 1,873 m/day (0.07 fps). That end velocity will be taken as the maximum desired velocity for this peer review and preliminary analysis; it should be noted that velocity exceeds the maximum described in the above paragraph by a factor of 59.

2.4. TP Reduction in Basins and Reservoirs

Proper consideration of certain of the alternatives requires estimation of the level of TP reduction which might be anticipated in basins and reservoirs upstream of any given STA. In this analysis those reductions are estimated by methods presented in *Phosphorus*

Removal by Urban Runoff Detention Basins, Lake and Reservoir Management, Volume 3; North American Lake Management Society; William Walker, 1987. A mean storage depth of 1 meter was assumed, as was a wet period fraction of 1.0. It should be noted that dryout, as contemplated in previous analyses of the EAA Storage Reservoir, would negatively influence those estimates. It is intended the influence of reservoirs on TP reduction be evaluated in more detail under Task 4 employing the DMSTA model.

3. STA-3/4

A schematic of the current design of STA-3/4 is presented in Figure 2, and is included herein to facilitate reference in the discussion of alternatives.

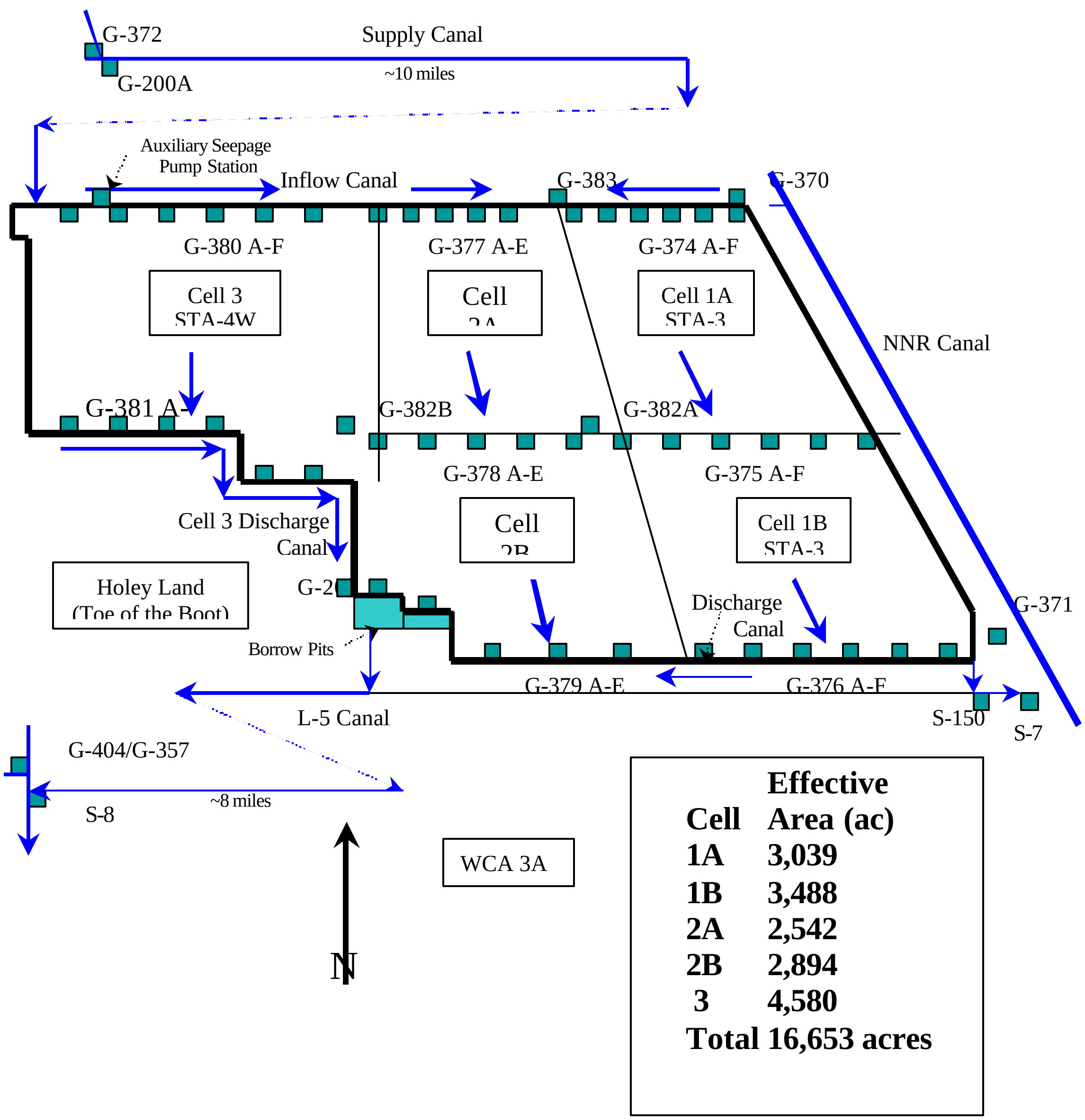


Figure 2. Schematic of STA-3/4

As presented in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies*, the estimated average annual inflows to STA-3/4 over the period 1965-1995 are 660,889 acre-feet per year at a flow-weighted mean inflow concentration of 88 ppb (72.0 metric tons inflow TP per year). Those estimates are relatively consistent with the estimated inflows presented in the June, 2000 *Plan Formulation* for STA3/4, prepared by Burns & McDonnell (average annual inflow of 645,222 acre-feet at a flow-weighted mean inflow concentration of 85 ppb, for 50% TP load reduction in basin runoff due to BMPs in the EAA). The *Plan Formulation* document projected a flow-weighted mean outflow concentration of 29 ppb for those inflows, using a k=16 m/yr and C^*=12 ppb (using average annual inflow estimates for each of the 31 years of the simulation). In those projections, an item of some significance was an estimated average annual reduction in inflows to STA-3/4 of just over 70,000 acre-feet per year due to deep (unrecovered) seepage losses from the Supply Canal to both the Expansion area and lands to the north.

3.1. Review of Proposed Alternatives

The District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* suggests a total of two alternatives for STA-3/4, comprised of:

- Integration with the EAA Storage Reservoirs CERP Project.
- Optimize performance of STA-3/4 within the existing footprint.

Given that the EAA Storage Reservoir is an authorized project, it is not truly an alternative; more properly, the baseline inflow volumes and loads should be expected to modify upon completion of the EAA Storage Reservoir (2009), and the baseline projections adjusted accordingly during the evaluation of alternatives. In essence, a "no action" alternative should properly include the EAA Storage Reservoir.

3.1.1. Alternative No. 1 –Integration with the EAA Storage Reservoirs CERP Project

The October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* postulates that, after the EAA Storage Reservoir Project becomes operational, there will be peak flow attenuation and some flow reduction into STA-3/4, and that there will also be a reduction in inflow TP loads to STA-3/4. The anticipated net effect of those modifications to inflow volumes and loads was projected to be an improved water quality performance in STA-3/4.

Information presented in the September, 1999 *Alternatives Analysis* for STA-3/4, prepared by Burns & McDonnell, was reviewed as an initial test of that hypothesis. Table 2.13 of the *Alternatives Analysis* summarizes estimated average annual inflow volumes and loads to STA-3/4 following completion of CERP (Alternative D-13R of the *Restudy*), based on analyses performed in connection with development of the *Restudy*. As presented in that tabulation, the average annual inflow volume to STA-3/4 is projected to increase to 697,200 acre-feet per year at a flow-weighted mean inflow concentration of 74 ppb (63.8 metric tons TP per year). It can therefore be anticipated that completion of the EAA Storage Reservoir project will increase average annual inflow volumes to STA-3/4 while reducing average annual inflow TP loads. However, the presence of the EAA Storage Reservoir immediately north of STA-3/4 and the Supply Canal can also be expected to reduce deep seepage losses due to higher stages in the areas to the north. That reduction in deep seepage losses to the north could effectively add 53,000 acre-feet of inflow to the treatment area itself.

Preliminary computations presented in Appendix B suggest that average annual inflows to the treatment area (after adjustment for deep seepage losses along the Supply Canal) could be modified from 590,702 acre-feet per year at an inflow concentration of 88 ppb (TP load of (64.3 metric tons TP per year) to 680,016 acre-feet per year at an inflow concentration of 74 ppb (62.2 metric tons TP per year). The estimated average annual outflows (using the k-C^* model with k=16 m/yr and C^*=12 ppb) would be modified from the baseline condition of 549,179 acre-feet per year at a concentration of 29 ppb (ave. TP load of 19.4 tonnes per year) to 638,493 acre-feet per year at a concentration of 29 ppb (ave. TP load of 22.6 tonnes per year).

It is therefore concluded that, given no change in the performance of the treatment area due to the presence of the EAA Storage Reservoir, there would be:

- Little or no change in the flow-weighted mean outflow concentration of TP.
- Roughly a 16% increase in average annual discharge volume.
- Roughly a 16% increase in average annual TP load discharged to the EPA.

There then remains the question of the extent to which the proposed operation of the EAA Storage Reservoir will contribute to an increased treatment performance as a result of peak flow attenuation (e.g., operation as a flow equalization basin, or FEB). As analyzed in the *Restudy*, average annual inflows to STA-3/4 associated with S-7 and S-8 basin runoff would average 184,600 acre-feet per year (as compared to a baseline condition of approximately 400,000 acre-feet per year). Inflows associated with Lake Okeechobee releases (primarily regulatory releases and regulatory releases stored in the EAA Reservoir for subsequent release as environmental water supply) would increase from the baseline estimate of roughly 220,000 acre-feet per year to over 480,000 acre-feet per year.

The operation of the EAA Reservoir as modeled in connection with the *Restudy* can therefore be expected to result in an increased variability in average annual inflows to STA-3/4, as compared to the baseline condition, and would not be expected to markedly improve treatment performance in STA-3/4.

3.1.2. Alternative 2 – Optimize Performance within Existing Footprint

This alternative contemplates conversion of parts of STA-3/4 to develop a composite biological treatment system within the existing footprint, generally composed of an emergent macrophyte STA followed in series by SAV and PSTA.

An initial treatment projection was performed based on an assumed 23.5%STA, 50% SAV, and 26.5% PSTA (in essence, Cells 1A and 2A were assumed divided into halves, with the upstream half developed as an STA and the downstream half developed as SAV; Cells 1B and 2B were also assumed to be divided into halves, with the upstream half in SAV and the downstream half in PSTA; that distribution was assumed paralleled in Cell 3). That projection resulted in an estimated mean outflow concentration of 19-20 ppb, as compared to 29 ppb for the baseline condition. Of particular interest is that the concentration reduction in the PSTA cells (4,413 acres) was but 2-3 ppb.

While it has been postulated that PSTA may be capable of driving TP concentrations to minimum levels below those for which STAs or SAV are capable, it is anticipated that the TP concentrations in STA-3/4 will not be reduced to a degree where that potential advantage is of interest. In essence, unless PSTA can be demonstrated to exhibit similar or greater net settling rates than SAV in a phosphorus concentration range of 15-25 ppb, <u>there appears to be no advantage to inclusion of PSTA in STA-3/4</u>. For this analysis, it has been assumed that Cells 1B and 2B, and a similar percentage of Cell 3, would be converted to SAV (approximately 53% of the total treatment area). The mean outflow concentration would be projected to be 18-19 ppb (see Appendix B).

Should the District elect to continue development of an alternative employing PSTA, it is anticipated that a more economical means of obtaining a shellrock or limerock substrate in STA-3/4 will consist of removing the peat soils to the surface of the underlying rock, as peat depths in the southerly portion of STA-3/4 are typically 1.5 feet or less, with isolated pockets exhibiting depths up to 2.5 feet (reference Figure 3.1 of the June 2000 *Plan Formulation* for STA-3/4).

3.2. Additional Alternatives Proposed for Consideration

It is suggested that the District at least consider additional alternatives wherein the overall treatment area of STA-3/4 is expanded.

For this preliminary analysis, a total of three potential alternatives are considered:

- Simple expansion developing a fourth parallel cell of STA-3/4, with all parallel flow paths equally loaded and considered as emergent macrophyte STAs.
- Expansion in series, in which all discharges from the current footprint of STA-3/4 are directed through the expansion area as a downstream cell or cells in series.
- Complex parallel expansion, in which the expansion area is considered as a fourth parallel flow path and the loading and operation of the current footprint of STA-3/4 is maximized.

It should be noted that, for this review and preliminary analysis, the lowest attainable outflow concentration for each of the three biological treatment systems has been assigned as 12 ppb. The net effect of this assignment is that incrementally large areas are required to closely approach that minimum attainable concentration. For this discussion, a target outflow concentration of 15 ppb is assumed; that assumption can be adjusted if desired should the District elect to further consider these additional alternatives. Preliminary estimates of overall treatment performance for each of these alternatives are presented in Appendix B. Those estimates are developed upon the assumption that the EAA Reservoir is in place and operational, as that is a more stringent loading condition than the baseline inflow estimates.

3.2.1. Alternative 3 – Simple Expansion

Under this alternative, a fourth parallel flow path would be added to STA-3/4, consisting of the expansion area. The entire treatment area would be considered to act as an emergent macrophyte STA with preliminary estimates of the steady state treatment analysis parameters of k=16 m/yr, C^*=12 ppb. It is estimated that a total treatment area of approximately 37,000 acres would be required to achieve a long-term mean outflow concentration of 15 ppb. That total area would be comprised of 16,653 acres within the current footprint of STA-3/4, and 20,347 acres in the expansion area. For uniformly distributed inflows, roughly 55% of the total inflow presently assigned to STA-3/4 would be redirected to the expansion area. A supplemental analysis was conducted in which the total area of the expansion was increased from 20,347 acres to 35,000 acres. The projected mean outflow concentration would be just under 13 ppb. In essence, an incremental area approaching 15,000 acres would yield an incremental reduction in outflow concentration of just over 2 ppb, demonstrating that extremely large areas of land would be needed to drive outflow concentrations markedly below 15 ppb.

3.2.2. Alternative 4 – Expansion in Series

Under this alternative, all inflows to STA-3/4 would pass through the current footprint, and all discharges from STA-3/4 would then be directed to the expansion area for further water quality improvement. It is assumed for this analysis that roughly 53% of the current footprint of STA-3/4 would be converted from an emergent macrophyte STA to SAV. In essence, Cells 1B and 2B would be converted (maximizing use of existing levees and structures), as would a similar percentage of Cell 3 (would require new levee and structure construction).

Given the steady-state treatment parameters assigned for this preliminary analysis, the flow-weighted mean outflow concentration from STA-3/4 would be roughly 19 ppb. An incremental expansion area of approximately 10,000 acres would be required to further reduce the mean concentration to 15 ppb.

3.2.3. Alternative 5 – Complex Parallel Expansion

Under this alternative, roughly 53% of the current footprint of STA-3/4 would be converted from an emergent macrophyte STA to SAV, and the loading on the current footprint limited to the maximum resulting in an estimated 15 ppb outflow concentration. For this preliminary analysis, roughly 73.5% of the net inflows to STA-3/4 would be assigned to the existing footprint, with the remaining 26.5% assigned to a new parallel flow path in the expansion area. For that inflow, approximately 9,800 acres in the expansion area would be required to lower the TP concentration to 15 ppb.

3.2.4. Alternative 6 – Distributed EAA Reservoir

All alternatives discussed to this point that consider the presence of the EAA Reservoir have proceeded using the estimated inflow volumes and TP loads to STA-3/4 taken from the analyses prepared for the Restudy, Alternative D13-R. Those analyses were developed upon the assignment of a single reservoir with three compartments, each roughly 20,000 acres in size, with all discharges toward the EPA directed through STA-3/4.

The current Project Management Plan (draft, for public input) for the EAA Storage Reservoir, Phase 1 contemplates that Phase 1 of the EAA Reservoir project will actually be developed on three separate parcels. Unlike the assumptions made for the Restudy analyses, those parcels are widely separated, occupying those lands acquired under the Talisman land exchange. The total area to be occupied by the three compartments is shown in that reference to be 49,901 acres. Of that total, 8,884 acres are assigned to a western compartment (Compartment C), occupying what is now the United States Sugar Corporation's Southern Division Ranch, Unit 2. An eastern compartment (Compartment B) encompasses 9,522 acres on lands adjacent to STA-2 and east of the North New River

Canal. The largest compartment (Compartment A) is comprised of 31,495 acres along and immediately north of the Holey Land Wildlife Management Area and STA-3/4.

Given that geographic arrangement, it is considered reasonable to anticipate that at least some part of the inflows directed to the originally contemplated reservoir will be distributed to Compartments B and C. That redistribution of inflows (and of reservoir discharges to STA-3/4 or other receiving treatment areas) is not presently known, and is one subject of additional SFWMM analyses now being conducted by the District. Those analyses, when completed, will not define the final distribution of inflows to and releases from the three compartments of the EAA Reservoir. That determination, as well as definition of the proposed operation of the reservoir(s), will be developed in preparation of the Project Implementation Report (PIR) for the EAA Reservoir, Phase 1. A draft of that PIR is presently scheduled for completion in August 2003. As a result, final definition of that distribution and operation will not be available prior to the completion of Basin-Specific Feasibility Studies (BSFS).

It is therefore considered appropriate during conduct of the BSFS to postulate at least one approach to the distribution of flows and general operation of the reservoirs that is directed toward incorporation of the reservoirs as an integral element of the overall water quality improvement strategy in the ECP Basins.

For this analysis, it is considered that an average of approximately 160,000 acre-feet per year of Lake Okeechobee releases are directed to Compartments B and C in lieu of Compartment A. The derivation of that assumption is included herein under the discussions for STA-2, Alternative 2 (Compartment B) and STA-5&6 (Compartment C). Average annual inflows to STA-3/4 from Compartment A are considered to be 160,000 acre-feet less than those considered in the previous alternatives for the STA-3/4 and Reservoir combination. It would be anticipated that the mean TP concentration in inflows to (and outflows from) the Reservoir would increase in parallel with that diversion. For this analysis, the mean TP concentration in outflows from the Reservoir are maintained at the 74 ppb value employed in the earlier analyses.

This alternative further assumes the conversion of approximately 53% of the current area of STA-3/4 to SAV (Cells 1B and 2B, and subdivision of Cell 3). Preliminary analysis of treatment performance (included in Appendix B) results in an estimated mean TP concentration in outflows from STA-3/4 of 15 ppb.

4. STA-5 AND STA-6

Given the highly interrelated nature of STA-5 and STA-6, the peer reviews and preliminary estimates of alternative performance for those treatment areas are considered as a single entity. Schematics of STA-5 and STA-6 are presented in Figures 3 and 4, respectively, to facilitate reference during subsequent discussion.

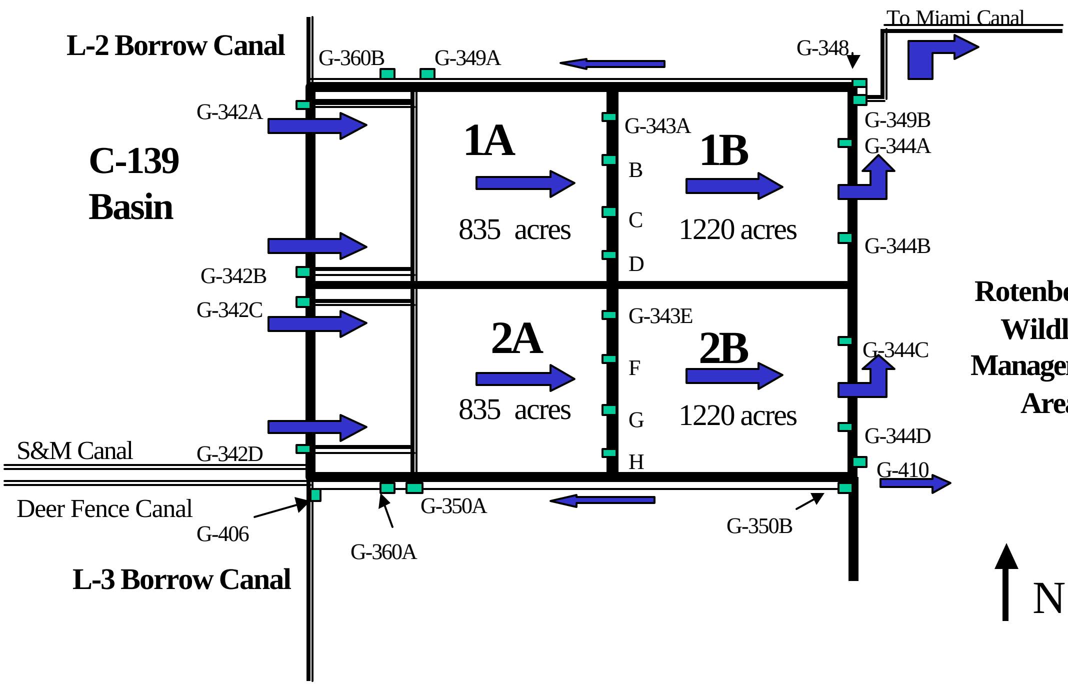


Figure 3. Schematic of STA-5

Figure 4 (schematic of STA-6) includes only the previously completed STA-6 Section 1. Current planning for the ECP contemplates expansion of STA-6 to include Section 2, which is intended to provide treatment for parts of the C-139 Basin runoff as well as discharges from the C-139 Annex. The current design for STA-6 Section 2 contemplates the addition of approximately 1,400 acres to the overall effective treatment area of STA-6.

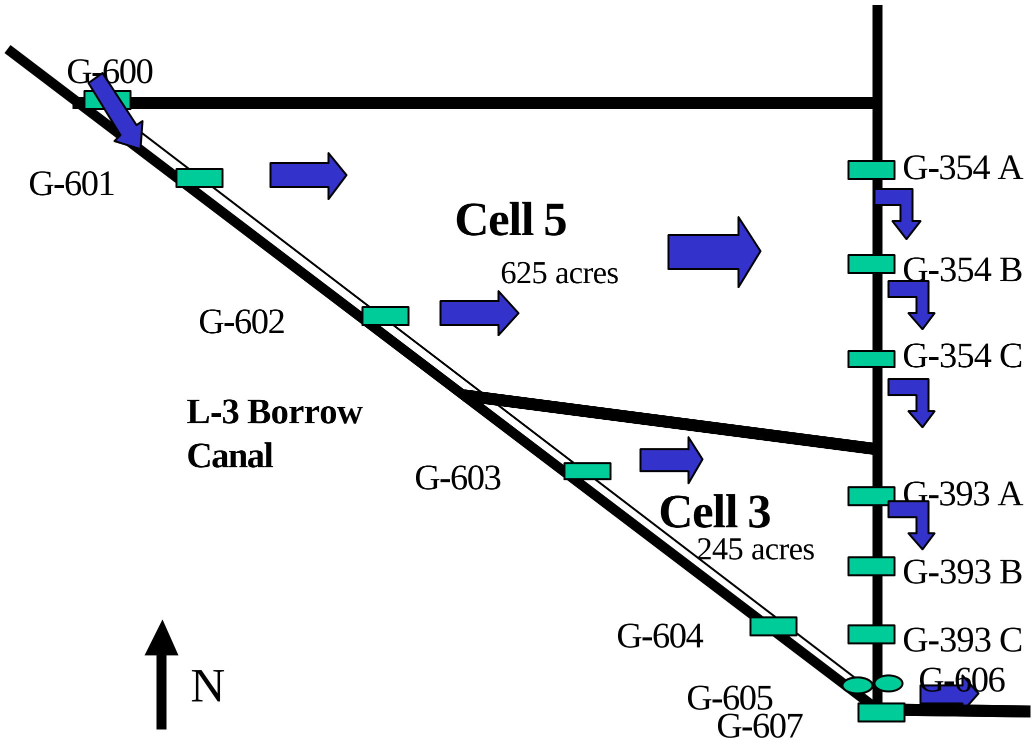


Figure 4. Schematic of STA-6 (Section 1)

A summary of the estimated inflows to STA-5 and STA-6 presented in the District's May 2001 *Baseline Data* is presented in Table 2.

Table 2. *Baseline Data* Inflows to STA-5 and STA-6

Inflows from Baseline Data (1965-1995)		**STA-5**	**STA-6**	**Total**
Description	**Units**			
Ave. Annual Inflow Volume	Ac-ft/yr	85,637	80,532	166,169
Ave. Annual Inflow TP Load	Kg/yr	17,634	12,050	29,684
Flow-weighted mean TP Concentration	Ppb	167	121	145

It is anticipated that the distribution of total inflows to the two treatment areas will be updated by the District in advance of the evaluation of alternatives under Task 4 of Contract C-E023, as the proportion of C-139 Basin inflows to STA-5 is understated and those to STA-6 are overstated in the above tabulation. Given that uncertain distribution of inflows to the two treatment areas, and in anticipation that the proper review of proposed alternatives for STA-5 and STA-6 will require disaggragation of inflows by source, it was considered necessary to establish a revised estimate of inflows for this preliminary analysis. Revised runoff estimates by source are summarized in Table 3.

Table 3. Runoff Estimates Used in Preliminary Analysis, STA-5 & STA-6

Estimated Runoff		Estimated Runoff by Source			Total
Description	**Units**	**C-139(1)**	**Annex(2)**	**S-8(3)**	
Ave. Annual Runoff Volume	Ac-ft/yr	122,530	12,640	16,640	151,810
Ave. Annual Runoff TP Load	Kg/yr	29,077	1,090	2,057	32,224
Flow-weighted mean TP Conc.	Ppb	192	70	100	172

Notes:
(1) Excerpted from the Excel spreadsheet "c139_final_flows&loads_xls" dated March 8, 2001, prepared by W. Walker for the C-139 Rulemaking effort. Data includes estimated inflows from L-3 and the G-342 structures, and excludes discharges from G-136, which are to be directed to STA-3/4. Average annual inflows are for the full period of Oct. 1978-April 2000 included in that source.
(2) Inflows from the C-139 Annex are taken from the August 9, 1996 *General Design Memorandum, Stormwater Treatment Areas No. 5 and 6*, Burns & McDonnell, and was based on data furnished by USSC for the period June 24, 1991 to February 2, 1994.
(3) Inflows from the S-8 Basin are from the United States Sugar Corporation (USSC) Southern Division Ranch Unit 2. Flow-weighted mean inflow concentration of 100 ppb taken from the District's Baseline Data spreadsheet "sta34 inflow tp.xls" for the S-8 Basin runoff, 1965-1995. Average annual runoff volume from the S-8 Basin of 187,579 acre-feet was taken from the same source; estimated area of the combined S-8/S-3 basin is 117,912 acres (ref. *Alternatives Analysis* for STA-3/4, Burns & McDonnell, September 1999). That volume excludes backpumping from the basin to Lake Okeechobee at S-3. A unit average annual runoff depth of 1.6 feet per year was applied to the 10,400-acre area presently tributary to STA-6 Section 1 to estimate average annual inflow volumes.

For the purpose of this preliminary analysis, the above runoff volumes and TP loads are distributed to STA-5 and STA-6 as indicated in Table 4. The following is a summary of the methods employed in that distribution.

- The total estimated runoff from the C-139 Basin (including discharges to the L-1 East Canal at G-136) is 138,646 acre-feet per year from the 168,437-acre C-139 Basin (0.823 ft/yr); the source of that runoff volume estimate is defined in Note 1 following Table 3. Upon completion of STA-6 Section 2, it is intended that runoff from the 37,514-acre Deer Fence Canal subbasin of the overall C-139 Basin be directed to STA-6. Upon the assumption of a uniform rate of runoff from the entire C-139 Basin, average annual inflow volumes from the

Deer Fence Canal to STA-6 are estimated to be (0.823 ft/yr)(37,824 ac.)=31,130 ac-ft/yr. C-139 Basin inflows to STA-5 would then consist of the remaining 91,400 acre-feet per year of C-139 Basin runoff delivered to the L-3 Canal.

- The S-8 Basin (USSC SDR Unit 2) runoff volumes presented in Table 3 are reduced to reflect the conversion of roughly 1,400 acres of the tributary area to use in STA-6 (remaining area of 9,000 acres).

Table 4. Revised Preliminary Baseline Inflows to STA-5 and STA-6

Estimated Inflow		**STA-5**	**STA-6**			
Description	**Units**		**Annex**	**S-8**	**C-139**	**Total**
Ave. Annual Inflow Volume	Ac-ft/yr	91,400	12,640	14,400	31,130	58,170
Ave. Annual Inflow TP Load	Kg/yr	21,690	1,090	1,780	7,387	10,257
Flow-weighted mean TP Conc.	ppb	192	70	100	192	143

Preliminary computations presented in Appendix B suggest that the flow-weighted mean average annual outflow concentrations (using the k-C^* model with k=16 m/yr and C^*=12 ppb) for both STA-5 and STA-6 would be 27 ppb under the revised baseline inflows. The analysis for STA-6 proceeded upon the assumption that Section 2 would be constructed in accordance with current District planning documents.

4.1. Review of Proposed Alternatives

The District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* suggests a total of three alternatives for STA-5 and STA-6, comprised of:

- Integration with the EAA Storage Reservoirs CERP Project.
- Optimize performance of both treatment areas within their existing footprints (including STA-6 Section 2).
- Expand the footprint of STA-5.

4.1.1. Alternative 1 – Integration with the EAA Storage Reservoirs CERP Project

Given that the EAA Storage Reservoir is an authorized project, it is not truly an alternative; more properly, the baseline inflow volumes and loads should be expected to modify upon completion of the EAA Storage Reservoir (2009), and the baseline projections adjusted accordingly during the evaluation of alternatives. In essence, a "no action" alternative should properly include the EAA Storage Reservoir. However, unlike STA-3/4, analyses conducted for the Restudy did not contemplate the Reservoir receiving inflows from the C-139 Basin (as was noted in the District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins*).

The current Project Management Plan (draft, for public input) for the EAA Storage Reservoir, Phase 1 identifies the area now occupied by the USSC Southern Division Ranch, Unit 2 as one component of the Phase 1 CERP project. As a result, it is considered appropriate to consider that area removed from the area tributary to STA-6 upon completion of the CERP project. For this preliminary analysis, it is assumed that the presently authorized CERP Project will act to:

- Remove Unit 2 runoff from inflows to STA-6.
- Reduce phosphorus concentrations in inflows to both STA-5 and STA-6.

It has been further assumed that:

- There would be no inflows from Lake Okeechobee or the S-8/S-3 Basin to the western compartment of the EAA Reservoir.

- All runoff from the C-139 Basin and the C-139 Annex would be introduced to the Reservoir, and subsequently released to STA-5 and STA-6 in proportion to their relative areas (e.g., equal hydraulic and phosphorus loading to both areas).

For this preliminary analysis, the reduction in phosphorus concentration in the western compartment of the EAA Reservoir is estimated by methods presented in *Phosphorus Removal by Urban Runoff Detention Basins*, Lake and Reservoir Management, Volume 3; North American Lake Management Society; William Walker, 1987. A mean storage depth of 1 meter was assumed.

Two possible cases were considered in the analysis. For Case 1, it was assumed that STA-6 Section 2 would not be constructed, and the area presently intended for conversion would instead be occupied by the western compartment of the EAA Reservoir. It was estimated that a net reservoir area of approximately 9,900 acres could be developed on the 10,200 acres of the USSC Southern Division Ranch, Unit 2 (includes approximately 1,400 acres presently scheduled for conversion to STA-6 Section 2).

For Case 1, average annual inflows to the Storage Reservoir are estimated to be 135,170 acre-feet at a mean TP concentration of 181 ppb. Outflows from the reservoir were estimated to average 110,485 acre-feet per year at a mean TP concentration of 100 ppb. Outflows from STA-5 and STA-6 were estimated to average 98,067 acre-feet per year at a mean TP concentration of 19 ppb.

For Case 2, it was assumed that STA-6 Section 2 would be constructed, adding approximately 1,400 acres of effective treatment area to STA-6 as presently planned. It was estimated that a net reservoir area of approximately 8,500 acres could be developed in the remaining area now occupied by the USSC Southern Division Ranch, Unit 2.

For Case 2, average annual inflows to the Storage Reservoir are again estimated to be 135,170 acre-feet at a mean TP concentration of 181 ppb. Outflows from the reservoir were estimated to average 113,976 acre-feet per year, again at a mean TP concentration of 100 ppb. Outflows from STA-5 and STA-6 were estimated to average 98,037 acre-feet per year at a mean TP concentration of 16 ppb.

4.1.2. Alternative 2 – Optimize Performance within Existing Footprints

The initial preliminary evaluation of this alternative (Case 1) proceeded upon the assumption that the western compartment of the EAA Storage Reservoir has not been constructed. The optimization is considered to consist of a conversion of elements of both treatment areas from an emergent macrophyte STA to SAV. As was the case for STA-3/4, it is not anticipated that TP concentrations within the treatment areas can be driven to levels low enough to warrant inclusion of PSTA, given its anticipated lesser net settling rate than that available in the SAV communities).

For this preliminary evaluation, it is assumed that Cells 1B and 2B of STA-5 are converted to SAV, with Cells 1A and 2A remaining as emergent macrophyte STA treatment areas. Of the total STA-5 treatment area of 4,110 acres, the downstream 2,440 acres (59%) would be converted to SAV. Given the steady-state treatment performance parameters discussed in Section 2, it is projected that the resultant mean outflow TP concentration from STA-5 would be reduced to 14 ppb (see Appendix B). It is further assumed that roughly one-half the total area of STA-6 (inclusive of Sections 1 and 2) would be converted to SAV. The analysis for this alternative again proceeded upon the assumption that the western compartment of the EAA Reservoir project is not constructed. That analysis, also included in Appendix B, projects a mean outflow TP concentration from STA-6 of 13 ppb.

A second variation on this alternative (Case 2) was also considered, wherein the western compartment of the EAA Storage Reservoir is constructed, with all runoff from the C-139 Basin and C-139 Annex delivered to the Storage Reservoir. For this case, there would be no runoff from the USSC Southern Division Ranch, Unit 2. This analysis is was similar to that conducted for Alternative 1, Case 2, with the exception that selected areas of both STA-5 and STA-6 (as discussed above) are converted to SAV.

For Case 2, average annual inflows to the Storage Reservoir are again estimated to be 135,170 acre-feet at a mean TP concentration of 181 ppb. Outflows from the reservoir were estimated to average 113,976 acre-feet per year, again at a mean TP concentration of 100 ppb. Outflows from STA-5 and STA-6 were estimated to average 98,037 acre-feet per year at a mean TP concentration of 12 ppb.

4.1.3. Alternative 3 – Expand Footprint of STA-5

This alternative contemplates expansion of STA-5 to the west (across the L-3 Canal). It is assumed for this preliminary analysis that a total of approximately 500 acres of land are available for that purpose west of L-3. It is anticipated that approximately 300 acres of effective treatment area could be developed on that parcel (after deductions for lands occupied by physical works such as levees and canals). In addition, it is assumed that the westerly 670 acres of lands acquired for STA-5 (not included in current treatment area due to elevation) and roughly 90 acres in the L-3 right-of-way could also be incorporated into an expanded STA-5 as an integral element of this alternative. Upon the above assumptions, the total treatment area in an expanded STA-5 would aggregate to roughly 5,170 acres.

For this preliminary evaluation, it is further assumed that the operation of STA-5 would concurrently be optimized through the conversion of lands from emergent macrophyte STA to SAV. As was the case for Alternative 2, it is assumed that Cells 1B and 2B would be converted. The total area in SAV would then aggregate to 2,440 acres, equivalent to 47% of the total area of the expanded STA-5. Preliminary analysis of the probable long-term performance of this alternative (see Appendix B) result in an estimated mean outflow concentration from STA-5 of 13 ppb. Supplemental analyses suggest that further expansion of the area converted to SAV of as much as 1,200 acres would result in a further reduction in outflow concentration of but roughly 0.5 ppb.

Under this alternative, there would be no change to estimated outflow volumes or concentrations from STA-6. For Alternative 2, Case 1 (optimized within the current footprint, no western compartment of the EAA Storage Reservoir), the projected outflow concentration from STA-6 is also 13 ppb.

4.2. Additional Alternative Proposed for Consideration (Alternative 4)

An additional alternative is proposed for the District's consideration in which the ability to deliver Lake Okeechobee releases to the western compartment of the EAA Reservoir is developed in concert with additional water quality improvement strategies for the C-139 Basin and C-139 Annex. Under this alternative, all discharges from the C-139 Basin and the C-139 Annex would be delivered to the western compartment of the EAA Storage Reservoir. Those inflows would be augmented by inflows from the Lake Okeechobee; the extent to which that augmentation is practicable is subject to substantial additional analysis. Discharges from the western compartment of the EAA Storage Reservoir would consist of:

- Environmental water supply releases to the Rotenberger Tract to satisfy demand functions in the Rotenberger Tract and downstream areas. Those releases would be made through STA-5, which would be dedicated as a treatment facility for such releases.
- Remaining releases from the western compartment of the EAA Storage Reservoir would be made to STA-6 for treatment prior to their release to the south. It is anticipated those releases would be generally toward the L-28 Borrow Canal and Pumping Station S-140

for eventual use to satisfy environmental water supply demands in western and southwestern areas of WCA-3A and downstream areas.

4.2.1. Conceptual Description of Physical Works

For this preliminary analysis, it is assumed that:

- The STA-5 Discharge Canal along the northerly perimeter of the Rotenberger Tract would be converted to use a means for conveying inflows from the S-8/S-3 Basin and Lake Okeechobee to the Storage Reservoir. The Discharge Canal would be extended westerly along the north line of STA-5 to a point near the northwesterly corner of STA-5. It is assumed that the extension of the Discharge Canal would be on lands presently occupied by STA-5, requiring a southerly relocation of the north perimeter levee. It is anticipated that a corridor approximately 200 feet in width would be required for that purpose, reducing the existing effective treatment area of STA-5 from 4,110 acres to 4,030 acres.
- A new pumping station would be constructed at the westerly end of the (extended) STA-5 Discharge Canal, lifting inflows from the S-8/S-3 Basin and Lake Okeechobee to the Storage Reservoir.
- The western compartment of the EAA Storage Reservoir would be developed on those lands presently contemplated for that purpose, as well as the additional 500 acres west of the L-3 Borrow Canal contemplated under Alternative 3 for an expansion of STA-5. Those two primary segments of the Storage Reservoir would be connected through the L-3 Borrow Canal at the present location of Structure G-406.
- A new pumping station would be constructed immediately north of the S&M Canal west of L-3, and would serve to lift inflows from the S&M Canal and the Deer Fence Canal into the Storage Reservoir.

- A new pumping station would be constructed on the L-3 Borrow Canal at or immediately north of the present north line of STA-5, and would serve to lift inflows from the C-139 Basin to the Storage Reservoir.
- Releases from the Storage Reservoir to STA-5 would be effected through the existing G-342 structures, and eventually released to the Rotenberger Tract through the existing G-344 structures and existing Pumping Station G-410. It should be noted that those releases would be rate limited, controlled by the hydraulic capacity of the Rotenberger Tract operated in conformance with desired regulation schedules.
- Other releases from the Storage Reservoir would be effected through STA-6 (both Section 1 and Section 2). Given the expansion of the Storage Reservoir to occupy additional lands west of L-3, it is assumed that it would be possible to expand the footprint of STA-6 by a like amount, potentially making up to 300 acres of additional lands available for use in STA-6.

4.2.2. Treatment Areas and Flow Distribution

For this analysis, STA-5 is assumed to provide a total of 4,030 acres of effective treatment area (reduced from 4,110 acres due to the conversion of area to use in the extended Discharge Canal). STA-6 is assumed to provide a total of 2,582 acres of effective treatment area (increased from the current design estimate by 300 acres in consideration of use of lands west of L-3 as a part of the EAA Storage Reservoir, western component).

Cells 1B and 2B of STA-5 are assumed to consist of SAV treatment area (total of 2,390 acres, or 59% of the total treatment area). STA-6 is assumed to be similarly developed as 41% emergent macrophyte STA followed by 59% SAV community.

Discharges from the western compartment of the EAA Reservoir are assumed to be apportioned to STA-5 and STA-6 on the basis of available treatment area (e.g., 60.9% to STA-5 and the balance to STA-6).

4.2.3. Preliminary Estimates of Treatment Performance

For this preliminary analysis, the reduction in phosphorus concentration in the western compartment of the EAA Reservoir is estimated by methods presented in *Phosphorus Removal by Urban Runoff Detention Basins*, Lake and Reservoir Management, Volume 3; North American Lake Management Society; William Walker, 1987. A mean storage depth of 1 meter was assumed.

For this analysis, it was presumed that additional inflows from Lake Okeechobee would be introduced to the western compartment of the EAA Storage Reservoir. Those inflows were assigned a mean TP concentration of 67 ppb (equal to the mean concentration in Lake releases to the Miami Canal over the period 1990-1999). The volume of those incremental inflows was increased by iterative analysis until the projected mean outflow TP concentration from STA-5 and STA-6 reached 15 ppb. Preliminary analyses of treatment performance for this case are included in Appendix B. It was estimated that an average of up to approximately 90,000 acre-feet per year could be introduced to the western compartment of the EAA Storage Reservoir, given that limitation on "final" discharge concentrations.

In this analysis, average annual inflows to the Storage Reservoir are estimated to be 225,170 acre-feet at a mean TP concentration of 135 ppb. Outflows from the reservoir were estimated to average 203,976 acre-feet per year at a mean TP concentration of 85 ppb. Outflows from STA-5 and STA-6 were estimated to average 187,489 acre-feet per year at a mean TP concentration of 15 ppb.

5. STA-2

STA-2 as constructed consists of three treatment cells arranged in parallel providing a total effective treatment area of 6,430 acres. A schematic of STA-2 is presented in Figure 5 to facilitate reference during subsequent discussion.

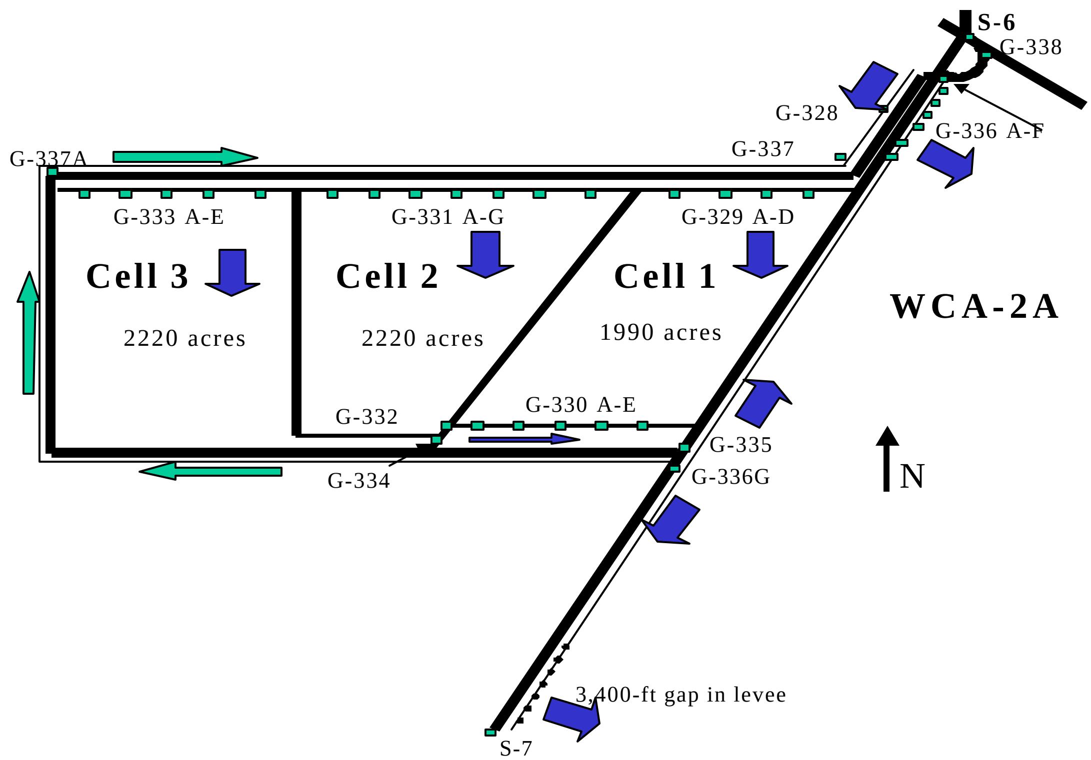


Figure 5. Schematic of STA-2

As presented in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies*, the estimated average annual inflow to STA-2 over the period 1965-1995 are 233,473 acre-feet per year at a flow-weighted mean inflow TP concentration of 100 ppb (28.83 metric tons inflow TP per year). Preliminary computations presented in Appendix B suggest that the flow-weighted mean average annual outflow concentrations (using the k-C^* model with k=16 m/yr and C^*=12 ppb) for STA-2 would be approximately 32 ppb under those baseline inflows.

5.1. Review of Proposed Alternatives

The District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* suggests a total of three alternatives for STA-2, comprised of:

- Integration with the EAA Storage Reservoirs CERP Project.
- Optimizing the performance of STA-2 within its existing footprint.
- Construction of a chemical treatment facility within the current footprint of STA-2.

5.1.1. Alternative 1 – Integration with the EAA Storage Reservoirs CERP Project

Given that the EAA Storage Reservoir is an authorized project, it is not truly an alternative; more properly, the baseline inflow volumes and loads should be expected to modify upon completion of the EAA Storage Reservoir (2009), and the baseline projections adjusted accordingly during the evaluation of alternatives. In essence, a "no action" alternative should properly include the EAA Storage Reservoir. However, unlike STA-3/4, analyses conducted for the Restudy did not contemplate the Reservoir receiving inflows from the S-6 basin. Alternative 1 as described the District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* simply noted that there may be an opportunity for exchange of water between STA-2 and Eastern compartment of the EAA Storage Reservoir. It was further postulated that such an exchange may improve the performance of STA-2 as compared to the baseline condition.

The current Project Management Plan (draft, for public input) for the EAA Storage Reservoir, Phase 1 identifies the area proposed for the eastern compartment of the EAA Storage Reservoir. Little or no of those lands are situated within the S-6/S-2 Basin tributary to STA-2. As a result, there is expected to be no significant reduction in STA-2 inflow volumes and loads resulting from construction of the EAA Storage Reservoir. Given that circumstance, the CERP Reservoir project as presently formulated would be considered to have no influence on the treatment performance of STA-2. This preliminary evaluation was conducted assuming that all inflows to STA-2 are first passed through the eastern compartment of the EAA Storage Reservoirs project.

For this analysis, the reduction in phosphorus concentration in the eastern compartment of the EAA Reservoir is estimated by methods presented in *Phosphorus Removal by Urban Runoff Detention Basins*, Lake and Reservoir Management, Volume 3; North American Lake Management Society; William Walker, 1987. A mean storage depth of 1 meter was assumed. The net available surface area of the 9,522-acre eastern compartment was assigned as 9,000 acres.

Two separate inflow cases were considered.

For Case 1, inflows to the reservoir were considered to consist only of the STA-2 baseline inflows from the S-6/S-2 (average annual inflow volume of 233,473 acre-feet at a flow-weighted TP concentration of 100 ppb). For that case, projected average annual outflows from the Storage Reservoir would be 211,032 acre-feet per year at a flow-weighted mean discharge concentration of 69 ppb. After those outflows are passed through STA-2, total average annual releases to the EPA are estimated to be 194,999 acre-feet per year at a flow-weighted mean TP concentration of 23 ppb.

For Case 2, it was considered that inflows from Lake Okeechobee would be introduced to the eastern compartment of the EAA Storage Reservoir in addition to the baseline inflows to STA-2. Those inflows were assigned a mean TP concentration of 71 ppb (mean concentration for releases to the North New River Canal over the period 1990-1999. The volume of those incremental inflows was assigned at 70,000 acre-feet per year (see discussion below for Alternative 2).

For Case 2, average annual inflows to the Storage Reservoir are estimated to be 303,473 acre-feet at a mean TP concentration of 95 ppb. Outflows from the reservoir were estimated to average 281,032 acre-feet per year at a mean TP concentration of 67 ppb. Outflows from STA-2 were estimated to average 264,999 acre-feet per year at a mean TP concentration of 28 ppb.

5.1.2. Alternative 2 – Optimize Performance of STA-2 Within Existing Footprint

The optimization is considered to consist of a conversion of elements of both treatment areas from an emergent macrophyte STA to SAV. As was the case for STA-3/4, it is not anticipated that TP concentrations within the treatment areas can be driven to levels low enough to warrant inclusion of PSTA, given its anticipated lesser net settling rate than that available in the SAV communities.

For this preliminary analysis, it was assumed that approximately 60% of the current effective treatment area of STA-2 would be converted to SAV. The estimated outflow concentration from that analysis, considering only the baseline inflows to STA-2, is 18 ppb (see Appendix B).

The potential influence of the eastern compartment of the EAA Storage Reservoir on the use and performance of STA-2 was then considered. As was the case for Alternative 1, it was assumed that all STA-2 baseline inflows would be first introduced to the Storage Reservoir. Additional inflows were considered to consist of Lake Okeechobee releases to the North New River. Those additional inflows were increased by iterative analysis until the projected mean outflow TP concentration from STA-2 reached 18 ppb (e.g., no change in mean outflow concentration from the initial analysis of Alternative 2). Preliminary analyses of treatment performance for this case are included in Appendix B. It was estimated that an average of up to approximately 70,000 acre-feet per year could be introduced to the eastern compartment of the EAA Storage Reservoir, given that limitation on "final" discharge concentrations.

5.1.3. Alternative 3 – Chemical Treatment Facility

This alternative includes constructing a chemical treatment facility within the footprint of STA-2. As stated in the District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins*, this would require conversion of a portion of STA-2 into a flow equalization basin, and the use of a portion of the existing STA-2 footprint for land disposal of residuals. Under this alternative, it is intended that there be no bypass (e.g., all discharges would pass through the treatment plant), as stated in the District's November 14, 2001 Final Draft *Evaluation Methodology for the Water Quality Improvement Strategies for the Everglades*. The presumed flow-weighted mean outflow concentration for this alternative is 10 ppb.

Two different cases were considered for this alternative. In Case 1, it is considered that a part of the STA-2 footprint is used for land disposal of residuals, as postulated by the District. For Case 2, it is considered that the land disposal site is situated outside the current footprint of STA-2, and the available area of the flow equalization basin is maximized in the interest of reducing the overall capacity and cost of the treatment plant.

For both cases, the maximum storage depth in the flow equalization basin is established at 4.5 feet. Treatment facilities are assumed constructed in modules, with the number of modules in operation at any given time controlled by the storage depth in the flow equalization basin. It has been further assumed that the peak hydraulic capacity of the treatment facility is equal to 1.5 times the nominal capacity. For this analysis, the basic operating "rule" for the plant, in which plant operation rates are tied to storage depths in the flow equalization basin, was defined as presented in Table 5. That "rule" was developed to generally parallel the depths which might be expected to result in the basin as a result of its own hydraulic constraints over the range of anticipated flows, and would be subject to substantial additional review during the conduct of Task 4.

Table 5. Assumed CTSS Capacity as a Function of FEB Storage Depth

FEB Storage Depth Range in Feet		Plant Operation (Percent of Design Hydraulic Capacity)
≥	<	
	0.50	0
0.50	1.00	70
1.00	1.50	80
1.50	2.00	90
2.00	2.50	100
2.50	3.00	112.5
3.00	3.50	125
3.50	4.50	137.5
4.50		150, Bypass Trigger

For Case 1, it was assumed that existing Cell 1 would be converted to use for the treatment plant and land disposal of residual solids. The net area of the flow equalization area was assigned at 4,440 acres, equal to the combined areas of Cells 2 and 3. Under the operating "rule" presented in Table 5, it was estimated that a design (nominal) plant capacity of 900 mgd would be required to avoid bypass over the period of record. The plant was estimated to be in operation 28% of the time over that 31-year period. The average operating rate of the plant (on those days when in operation) was estimated to be 758 mgd.

For Case 2, it was assumed that 100 acres of Cell 1 would be converted to use for the treatment plant, and land disposal of residual solids would take place off site. The balance of STA-2 was considered converted to use as the flow equalization basin, yielding a total basin area of 6,330 acres. Under the operating "rule" presented in Table 5, it was estimated that a design (nominal) plant capacity of 800 mgd would be required to avoid bypass over the period of record. The plant was estimated to be in operation 31% of the time over that 31-year period. The average operating rate of the plant (on those days when in operation) was estimated to be 662 mgd.

More definitive estimates of plant capacity will be developed during the conduct of Task 4 under Contract C-E023, during which the operating rules for the plant will be adjusted as appropriate to minimize plant capacity and maximize use of the available volume in the flow equalization basin. However, on the basis of the estimates presented herein, it appears that land disposal of residual solids in Cell 1 would require an increase of roughly 100 mgd in the nominal plant capacity.

In the December 2000 Final Report *Chemical Treatment Followed by Solids Separation Advanced Technology Demonstration Project*, prepared for the District by HSA Engineers & Scientists, et al, the total present cost (including capital cost and demolition/replacement cost, but excluding operating costs) of a 390 mgd post-STA CTSS plant was estimated to be $107,767,669, or $276,327/mgd. It would therefor appear that the increased first cost for the plant itself associated with the disposal of residual solids within the footprint of STA-2 could be taken as roughly $27.6 million. Assuming costs for conversion of STA-2 to a flow equalization basin to be roughly the same for Case 1 and Case 2, it is considered highly unlikely that the cost for acquisition of off-site lands and increased costs for transportation of the residual solids would approach that value. <u>It is therefore recommended that the detailed evaluation to be conducted under Task 4 be based on an assumption of off-site disposal of residual solids</u>.

It is further noted that all inflows to the CTSS are intended to pass through the flow equalization basin. Given that assumption, it is further suggested that this alternative be developed and evaluated under Task 4 on the following basis:

- The CTSS be developed as a post-STA facility.

- The performance of STA-2 in reducing phosphorus concentrations be optimized generally as described earlier for Alternative No. 2 (e.g., consider the CTSS as an incremental treatment facility in series with STA-2).
- Bypass of the CTSS be permitted (e.g., allow some presently undefined proportion of the STA-2 outflows to be directly discharged to WCA-2A).
- Develop the required capacity of the CTSS such that the blended outflows from STA-2 (those directly discharged to WCA-2A) and the CTSS result in the target long-term mean flow-weighted TP concentration.
- The potential for inclusion of a solids dewatering process be evaluated on an economic basis (e.g., increased capital and operating costs as a potential trade-off for reduced costs for transportation and land application of the residual solids).

The primary objectives in further development of this alternative on the above basis are to:

- Minimize the required capacity and operation of the CTSS.
- Maximize the use of STA-2 in reducing total phosphorus.
- Ameliorate the concern over CTSS discharge toxicity by blending its discharges with those from the wetland treatment facility.

6. STA-1 EAST

The present design for STA-1E provides three parallel flow paths, each developed with cells in series, preceded by distribution cells located along and parallel to the C-51 Canal. A schematic of STA-1E is presented in Figure 6 to facilitate reference during subsequent discussion.

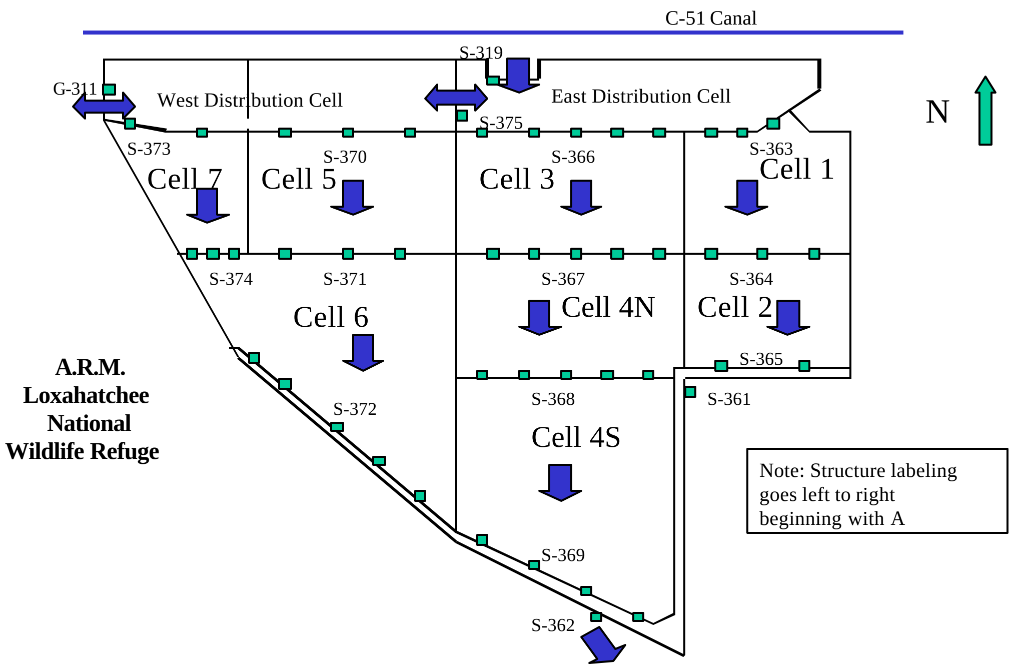


Figure 6. Schematic of STA-1E

A listing of the estimated areas of the various cells of STA-1E is presented in Table 6; those areas are taken from the May 11, 2000 *Stormwater Treatment Area 1 East, Period of Record Dry-Out Analysis* prepared for the Jacksonville District, U.S. Army Corps of Engineers by Burns & McDonnell.

Table 6. Cell Areas in STA-1E

Location	**Cell Identification**	**Area in acres**
Distribution Cells (1,046 acres total)	East Distribution Cell	470
	West Distribution Cell	576
Easterly Flow Path (1,108 acres total)	1	556
	2	552
Central Flow Path (1,986 acres total)	3	589
	4 North	645
	4 South	752
Westerly Flow Path (2,038 acres total)	5	571
	6	1,049
	7	418
Total Treatment Area, Excluding Distribution Cells		**5,132**

As presented in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies*, the estimated average annual inflow to STA-1E over the period 1965-1995 are 133,473 acre-feet per year at a flow-weighted mean inflow TP concentration of 176 ppb (28.95 metric tons inflow TP per year). Preliminary estimates of the treatment performance of STA-1E under the baseline condition are presented in Appendix B.

For the baseline estimate, the contribution of the distribution cells to TP reduction was estimated by methods presented in *Phosphorus Removal by Urban Runoff Detention Basins*, Lake and Reservoir Management, Volume 3; North American Lake Management Society; William Walker, 1987. A mean storage depth of 1 meter was assumed. Estimates of average annual rainfall and evapotranspiration were taken from the May 11, 2000 *Stormwater Treatment Area 1 East, Period of Record Dry-Out Analysis.* Net seepage losses were assigned at 0.1 m/yr. For those conditions, projected average annual outflows from the STA-1E Distribution cells to the treatment area were estimated to be 134,400 acre-feet per year at a flow-weighted mean TP concentration of 125 ppb.

Given those revised inflows, the preliminary analysis of the performance of STA-1E under baseline conditions suggest that the flow-weighted mean average annual outflow concentrations (using the k-C^* model with k=16 m/yr and C^*=12 ppb) would be approximately 27 ppb.

6.1. Review of Proposed Alternatives

The District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* suggests a total of three alternatives for STA-1E, comprised of:

- Integration with the C-51 and Southern L-8 Reservoir CERP Project.
- Optimizing the performance of STA-1E within its existing footprint.
- Expand STA-1E to achieve the lowest sustainable TP concentration

6.1.1. Alternative 1 – Integration with the C-51 and Southern L-8 Reservoir CERP Project

As described on the CERP project website, the C-51 and L-8 Reservoir (part of the Northern Palm Beach County Project, Part 1), is a separable CERP element. It includes a combination above-ground and in-ground reservoir with a total storage capacity of approximately 48,000 acre-feet located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County. The initial design for the reservoir assumed an 1,800 acre reservoir (1,200 usable acres) with the water level fluctuating from 10 feet above grade to 30 feet below grade. A more complete description of this project is included in Appendix A.

It is not apparent from that description that the construction and operation of this project will act to substantively reduce STA-1E inflow volumes and TP loads. At this juncture, sufficient data to permit preliminary evaluation of the influence of this alternative on the treatment performance of STA-1E is not available to Burns & McDonnell.

6.1.2. Alternative 2 – Optimize the Performance of STA-1E Within its Existing Footprint

The optimization is considered to consist of a conversion of elements of both treatment areas from an emergent macrophyte STA to SAV. As was the case for STA-3/4, it is not anticipated that TP concentrations within the treatment areas can be driven to levels low enough to warrant inclusion of PSTA, given its anticipated lesser net settling rate than that available in the SAV communities.

For this preliminary analysis, it is assumed that Cells 2, 4 North, 4 South, and 6 are converted to SAV (total area of 2,998 acres, or 58.4% of the total treatment area in STA-1E). Under that assumption, and upon assignment of a net settling rate of 36 m/yr with a “background” or minimum attainable concentration of 12 ppb, the estimated long-term mean TP concentration in outflows from STA-1E would be 15 ppb (see Appendix B).

6.1.3. Alternative 3 – Expand STA-1E to Obtain the Lowest Sustainable TP Concentration

Inasmuch as the lowest attainable TP concentration for both SAV and PSTA have for this peer review and evaluation been taken as 12 ppb, and given the assigned higher net settling rate for SAV, it is considered that any expansion in the footprint of STA-1E would be developed as SAV.

For this analysis, the conversion considered above for Alternative 2 is considered to be in place, and the area assigned to SAV was increased iteratively until the computed TP concentration fell below 12.5 ppb. In that analysis (included in Appendix B), a total SAV community of 5,350 acres (expansion of 2,352 acres) was computed as the area necessary to obtain a computed outflow concentration of 12.49 ppb. The total expanded treatment area of STA-1E would then be 7,484 acres (exclusive of the 1,046 acres in the distribution cells).

6.2. Review of Additional Alternatives (Acme Improvement District Basin B)

In a communication dated December 19, 2001, the District requested peer review of two additional alternatives for STA-1E. Those alternatives, based on certain options contained in a July 11, 2001 document titled *Basin B Water Quality Cleanup Options Opinion of Probable Cost* (prepared by a Storm Water Action Team, or SWAT, established by the Village of Wellington and the Acme Improvement District), include:

- Expansion of STA-1W (and possibly STA-1E) to treat runoff from the Acme Basin B.
- Modification of STA-1E to allow diversion of the runoff from Acme Basin B to the Palm Beach Aggregates rock pit.

6.2.1. Alternative 4 – Expand STA-1W, STA-1E to Treat Acme Basin B

This alternative is based on *Option 1 – STA 1 West "Bolt On"* as presented in the July 2001 *Basin B Water Quality Cleanup Options Opinion of Probable Cost*. The basic intent of this alternative is to redirect Basin B discharges to STA-1E, and, to the extent necessary to achieve the lowest sustainable concentration from a composite treatment system, redirect other inflows to STA-1E to STA-1W. That redirection of inflows can be expected to concurrently require an increase in the effective treatment area of STA-1W.

Two separate cases were considered under this alternative. For Case 1, Acme Basin B discharges are considered to be redirected to and added to the current (*Baseline*) inflows to STA-1E. No redirection of other inflows to STA-1E is considered under Case 1. For Case 2, it has been assumed that all S-5A Basin runoff is directed to and treated in STA-W, thereby reducing total inflows to STA-1E.

Case 1

For Case 1, it is assumed that:

- All discharges from the Acme Improvement District Basin B are redirected to STA-1E.
- The footprint of STA-1E is expanded to the extent necessary to result in a long-term flow-weighted mean TP concentration in discharges from STA-1E of 15 ppb.

As presented in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies*, the estimated average annual discharges from Basin B over the period 1965-1995 are 31,499 acre-feet per year at a flow-weighted mean inflow TP concentration of 94 ppb (3.66 metric tons inflow TP per year). Those inflows were added to the previously estimated inflows for STA-1E, and the area of STA-1E developed in SAV was increased in an iterative analysis until the projected mean outflow concentration reached 15 ppb. The area of STA-1E assigned as emergent marsh was maintained at the 2,134-acre value considered in Alternatives 2 and 3.

The results of that analysis (presented in Appendix B) suggest that it would be necessary to expand the current footprint of STA-1E by approximately 1,102 acres to obtain that target outflow concentration.

Case 2

For Case 2, it is assumed that:

- All discharges from the Acme Improvement District Basin B are redirected to STA-1E.

- All currently projected inflows from the S-5A Basin to STA-1E are redirected to STA-1W (e.g., no inflow to STA-1E at proposed Structure G-311).
- The footprint of STA-1E is expanded to the extent necessary to result in a long-term flow-weighted mean TP concentration in discharges from STA-1E of 15 ppb.
- The footprint of STA-1W is concurrently expanded to the extent necessary to result in a long-term flow-weighted mean TP concentration in discharges from STA-1W of 15 ppb. The expansion of STA-1W associated with this alternative is discussed as Alternative 3 for STA-1W in a subsequent section of this document.

As presented in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies* (specific reference to the Excel spreadsheet entitled "sta1E inflow tp.xls"), the estimated average annual inflows to STA-1E from the S-5A Basin over the period 1965-1995 are 22,552 acre-feet per year at a flow-weighted mean inflow TP concentration of 133 ppb (3.70 metric tons inflow TP per year). Those inflows were deducted from the Alternative 4 estimated inflows for STA-1E, and the area of STA-1E developed in SAV was increased in an iterative analysis until the projected mean outflow concentration reached 15 ppb. The area of STA-1E assigned as emergent marsh was maintained at the 2,134-acre value considered in Alternatives 2 and 3.

The results of that analysis (presented in Appendix B) suggest that it would be necessary to expand the current footprint of STA-1E by approximately 407 acres to obtain that target outflow concentration. The required concurrent expansion of STA-1W is discussed in a subsequent section of this document.

6.2.2. Alternative 5 – Divert Acme Basin B to Palm Beach Aggregates Rock Pit

This alternative is based on *Option 2 – GKK Rock Pit/Adjacent STA* as presented in the July 2001 *Basin B Water Quality Cleanup Options Opinion of Probable Cost*. This option assumes changing the basic flow pattern in the Basin B canals from south-southwest to north-northwest. Under this option, the C-51 Canal would be used to channel the Wellington discharges westward to the L-8 Canal, which would then be used to convey those discharges north to the mining operation and the pits created by the GKK operation. As described in the July 2001 document, each of the existing GKK pits is approximately 100 acres in size. One pit would act as a reservoir storage area. An additional section of land would be required for an STA. Once the water has passed through the STA, it could be divided to the L-8 Canal, M-1 Canal, north to the Loxahatchee Slough; C-51 Canal and WCA-1, or northwest to Lake Okeechobee.

A number of key uncertainties limit the extent to which an evaluation of this alternative may fully proceed. Those uncertainties include:

- The extent to which the proposed utilization of the rock pit(s) as a storage reservoir may conflict or be compatible with the C-51 and L-8 Reservoir CERP project.
- The relative timing of inflows to the C-51 Canal from the C-51 West Basin and Acme Basin B, with the result that the distribution of TP loads between the proposed diversion works and STA-1E is not currently subject to precise estimation.
- The extent to which runoff volumes entering the C-51 Canal will be distributed between STA-1E and the proposed diversion works.
- Target TP concentrations in discharges from the diversion works, which may or may not be delivered, in full or in part, to the Everglades Protection Area.

The following <u>assumptions</u> have been made to permit this preliminary evaluation to proceed:

- Discharges from Acme Basin B are considered discharged to the C-51 West Canal and fully mixed with runoff from the C-51 West Basin.

- A volume of runoff equal to that discharged from Acme Basin B is assumed to be withdrawn from the C-51 Canal and delivered to the proposed 100-acre storage reservoir.
- Remaining (fully mixed) runoff from the C-51 West Basin and Acme Basin B is considered delivered to the Distribution Cells in STA-1E.
- Inflows to STA-1E from the S-5A Basin and supplemental (STA irrigation) water from Lake Okeechobee are considered delivered to the Distribution Cells in the average annual amounts reflected in the District's *Baseline Data*.
- The 100-acre storage reservoir is assumed to operate at a mean depth of 5 meters, with no dryout.
- The additional STA nominally adjacent to the proposed 100-acre storage reservoir is assumed developed as 40% emergent macrophyte and 60% SAV, and sized for a long-term flow-weighted mean outflow TP concentration of 15 ppb.
- There would be no expansion of STA-1E; a total of 2,998 acres of the STA is considered converted to SAV, similar to the above discussion of Alternative 2 for STA-1E.

A summary of potential average annual inflows to STA-1E, taken from the District's Baseline Data, is presented in Table 7.

Table 7. Summary of Baseline Data Potential Inflows to STA-1E

Source	Estimated Average Annual Potential Inflow		
	Volume (ac-ft)	**TP Load (kg)**	**TP Conc (ppb)**
S-5A Basin	22,552	3,703	133
Lake Okeechobee	631	109	140
C-51 West at S-319	105,202	24,009	185
C-51 West at S-362	4,946	1,129	185
Acme Basin B	31,499	3,660	94
All Potential Inflows	**164,830**	**32,610**	**160**

Table 8 summarizes the estimated inflows to the STA-1E Distribution Cells and the 100-acre storage reservoir, given the assumptions defined above.

Table 8. Estimated Inflows for STA-1E Alternative 5

Source	Estimated Average Annual Potential Inflow		
	Volume (ac-ft)	**TP Load (kg)**	**TP Conc (ppb)**
Estimated Inflows to STA-1E Distribution Cells			
S-5A Basin	22,552	3,703	133
Lake Okeechobee	631	109	140
S-319 (C-51 & Acme)	105,202	21,293	164
C-51 West at S-362	4,946	1,129	185
STA-1E Alt. 5 Total	**133,331**	**26,234**	**160**
New Reservoir	**31,499**	**6,376**	**164**
Total Inflows	**164,830**	**32,610**	**160**

Preliminary treatment performance estimates for Alternative 5 are presented in Appendix B. The projected long-term flow-weighted mean TP concentration in outflows from STA-1E is 15.2 ppb. It is further anticipated that an effective treatment area of approximately

1,145 acres would be required in the "new" treatment area at the GKK rock pit to achieve a long-term flow-weighted mean TP concentration of 15 ppb in outflows from that additional treatment area.

7. STA-1 WEST

The present design for STA-1W provides two parallel flow paths, each developed with cells in series. The most northerly flow path includes Cells 5A and 5B, which combined provide a treatment area of 2,855 acres. The most southerly flow path is further divided into two parallel flow paths, the most easterly of which is comprised of Cells 1 and 3 (total area of 2,516 acres). The westerly flow path is comprised of Cells 2 and 4, which combined provide a total treatment area of 1,299 acres. The total treatment area in STA-1W as constructed is 6,670 acres. A schematic of STA-1W is presented in Figure 7 to facilitate reference during subsequent discussion.

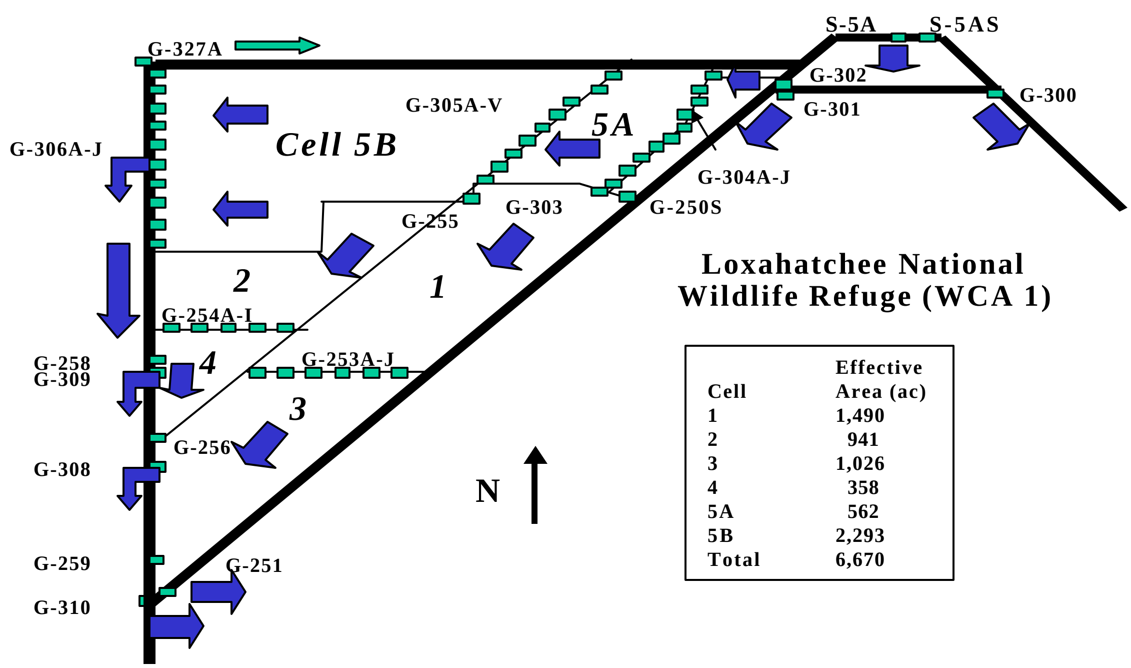


Figure 7. Schematic of STA-1W

As presented in the District’s May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies*, the estimated average annual inflow to STA-1W over the period 1965-1995 are 160,335 acre-feet per year at a flow-weighted mean inflow TP concentration of 139 ppb (27.40 metric tons inflow TP per year). A preliminary estimate of the treatment performance of STA-1W under the baseline condition is presented in Appendix B. In that analysis, the entire treatment area was considered to act as an emergent macrophyte STA with preliminary estimates of the steady state treatment analysis parameters of k=16 m/yr, C^*=12 ppb. The projected long-term mean TP concentration in outflows from STA-1W under baseline conditions is 26 ppb.

7.1. Review of Proposed Alternatives

The District's October 30, 2001 draft of *Preliminary Alternative Combinations for the ECP Basins* suggests a total of two alternatives for STA-1W, comprised of:

- Integration with the C-51 and Southern L-8 Reservoir CERP Project.
- Optimizing the performance of STA-1E within its existing footprint.

7.1.1. Alternative 1 – Integration with the C-51 and Southern L-8 Reservoir CERP Project

A summary description of this CERP Project is included in Section 6 above and in Appendix A. In the *Preliminary Alternative Combinations for the ECP Basins,* it is postulated that the partial diversion of C-51 West basin runoff to the Reservoir should negate the need to transfer about 11,500 acre-feet per year from STA-1W to STA-1E.

The composition of inflows to STA-1W as summarized in the *Preliminary Alternative Combinations for the ECP Basins* was taken from the District's Excel file "sta1w inflow tp.xls". That file was reviewed to confirm the estimated average annual diversion from STA-1E to STA-1W in the baseline data. It was determined that the average annual inflows to STA-1W summarized in the District's May, 2001 *Baseline Data for the Basin-Specific Feasibility Studies* includes no contribution from STA-1E at Structure G-311. As a result, inflows to STA-1W were not adjusted in this evaluation for the diversion of C-51 West runoff to the CERP Reservoir.

However, the proposed location of the Reservoir in the S-5A Basin could be considered to result in a reduction in STA-1W inflow volumes and TP loads due to removal of approximately 1,800 acres of tributary area to be occupied by the Reservoir.

The total area of the S-5A Basin is approximately 123,369 acres (taken from the February 15, 1994 *Everglades Protection Project Conceptual Des*ign prepared for the District by Burns & McDonnell. Following construction of STA-1W, it is assumed that the net area of the S-5A basin reflected in the SFWMM simulations is approximately 116,700 acres. It is noted that completion of the S-5A Basin Diversion under the ECP will have redirected some part of the runoff from the S-5A Basin to STA-2; the degree to which that diversion is reflected in the *Baseline Data* is unknown. From the District's Excel file "sta1w inflow tp.xls", the average annual basin runoff from the S-5A Basin under the baseline condition is estimated to be 139,891 acre-feet per year at a flow-weighted mean TP concentration of 138 ppb. Neglecting the influence of the S-5A Basin Diversion, the average annual runoff depth from the 116,700 acre basin would be1.1987 feet per year. In comparison, Table III-6 of the *Conceptual Design* projected an aerial adjustment factor of 1.6418 feet for the S-5A Basin.

The *Conceptual Design* further intended the average annual diversion of approximately 39,600 acre-feet from the S-5A Basin to STA-2. Accounting for that diversion, the projected "net" runoff depth from the S-5A Basin to STA-1W would have been 1.30 feet, which compares reasonably well with the above estimate of 1.1987 feet.

As a result, the preliminary evaluation of this alternative proceeded on the assumption that the average annual inflows to STA-1W would be reduced by 2,880 acre-feet per year (at a mean TP concentration of 138 ppb). That reduction is due to the conversion of 1,800 acres to use in the CERP Reservoir (1,800 acres at an average runoff depth of 1.6 feet). The adjusted average annual inflows to STA-1W would then be 157,445 acre-feet at a mean TP concentration of 139 ppb. No significant change in outflow concentration from STA-1W would be projected to result from that slight reduction in inflows (see preliminary analysis in Appendix B).

7.1.2. Alternative 2 – Optimize Performance of STA-1W Within Existing Footprint

The optimization is considered to consist of a conversion of elements of both treatment areas from an emergent macrophyte STA to SAV. As was the case for STA-3/4, it is not anticipated that TP concentrations within the treatment areas can be driven to levels low enough to warrant inclusion of PSTA, given its anticipated lesser net settling rate than that available in the SAV communities.

For this preliminary analysis, it is assumed that Cells 3, 4 and 5B are converted to SAV. Given the relatively complex hydrography of STA-1W and the presence of what are in essence three flow paths of substantially unequal areas, it was considered desirable to analyze each flow path separately. Inflow volumes and TP loads were assumed distributed evenly to the three flow paths on the basis of area (e.g., uniform hydraulic and TP loading of the three parallel paths). Inflow volumes and loads as for the baseline condition were employed in the analysis. Under that assumption, and upon assignment of a net settling rate of 36 m/yr with a "background" or minimum attainable concentration of 12 ppb for the SAV communities, the estimated long-term mean TP concentration in outflows from STA-1W would be approximately 16 ppb (see Appendix B). The net settling rate for STA-1W as a whole was estimated to be 25.71 m/yr.

A supplemental analysis was prepared in which only Cells 4 and 5B were considered as converted to SAV; Cell 3 was considered to remain an emergent macrophyte STA. For that supplemental analysis, the estimated long-term mean TP concentration in outflows from STA-1W was projected to be 19 ppb. The net settling rate for STA-1W as a whole was estimated to be 21.05 m/yr.

7.2. Review of Additional Alternative (Acme Improvement District Basin B)

In a communication dated December 19, 2001, the District requested peer review of two additional alternatives for STA-1E. Those alternatives, based on certain options contained in a July 11, 2001 document titled *Basin B Water Quality Cleanup Options Opinion of Probable Cost* (prepared by a Storm Water Action Team, or SWAT, established by the Village of Wellington and the Acme Improvement District), include:

- Expansion of STA-1W (and possibly STA-1E) to treat runoff from the Acme Basin B (STA-1E Alternative 4).
- Modification of STA-1E to allow diversion of the runoff from Acme Basin B to the Palm Beach Aggregates rock pit (STA-1E Alternative 5).

An evaluation of those additional alternatives relative to the projected treatment performance of STA-1E is presented in an earlier section of this document. Implementation of the first of those additional alternatives may require the concurrent expansion of STA-1W. Alternative 3 for STA-1W is considered as a companion project to Alternative 4, Case 2 for STA-1E.

Under Alternative 3 for STA-1W, average annual inflows to STA-1W are increased by the volumes and total phosphorus loads from the S-5A Basin presently assigned to STA-1E (average annual inflow volume of 22,552 acre feet, average annual inflow TP load of 3,703 kilograms). When combined with the Baseline inflows, the resultant total average annual inflows to STA-1W under Alternative 3 are 182,887 acre feet at a mean inflow TP concentration of 138 ppb (31,102 kilograms TP per year).

For this analysis, it is assumed that an additional parallel flow path would be added to STA-1W, lying generally west of and adjacent to the existing stormwater treatment area, and that the delivery of discharges to the expansion area will require the conversion of a strip of land along the north line of Cells 5A and 5B to use as an additional inflow canal. It is anticipated that the strip of land would be approximately 250 feet wide to permit the construction of the new distribution canal and north perimeter levee for Cell 5 interior of the existing north perimeter levee. As a result, it is anticipated that roughly 20 acres of treatment area in Cell 5A and 85 acres in Cell 5B would be required for construction of the new canal and levee.

For this preliminary analysis, it is assumed that Cells 3, 4 and 5B are converted to SAV. Given the relatively complex hydrography of STA-1W and the presence of what would be in essence four flow paths of substantially unequal areas, it was considered desirable to analyze each flow path separately. Inflow volumes and TP loads were assumed distributed evenly to the four (three existing and one new) flow paths on the basis of area (e.g., uniform hydraulic and TP loading of the three parallel paths). Inflow volumes and loads as for the baseline condition were employed in the analysis, increased to reflect the incremental volumes and loads diverted from STA-1E. The fourth (new) flow path was considered developed as 40% in emergent macrophyte marsh, and 60% in SAV. The effective treatment area in the expansion was adjusted by iterative analysis until the long-term mean flow-weighted TP concentration in the aggregate discharge from STA-1W was estimated to reach 15 ppb. It was estimated that an effective treatment area of approximately 1,500 acres would be required; the net increase in the effective treatment area of STA-1W would be 1,395 acres, after consideration of the 105 acres assumed converted to use for a new inflow canal and levee.

A supplemental analysis was prepared in which it was assumed that the target outflow concentration from this alternative would be equal to that for Alternative 2 (e.g., 15.85 ppb, representing no degradation in water quality resulting from the diversion of flows from STA-1E). That supplemental analysis resulted in an estimated effective treatment area in the expansion of 965 acres.

Appendix A

CERP Project Descriptions

Project Management Plan
Project Documents
Team Calendar
Glossary of Project Terms

USACE Project Manager:
Brad Clark
Bradley.E.Clark@saj02.usace.army.mil

SFWMD Project Manager:
Victor Powell
vpowell@sfwmd.gov

Project Schedule:
Start - 31 Jan 2001
End - 16 Sep 2009

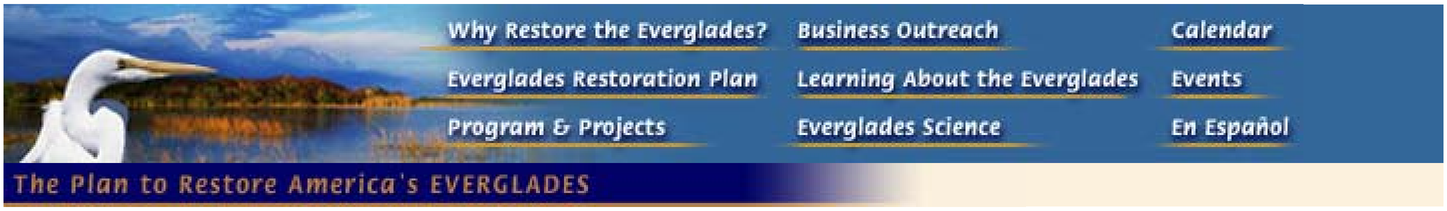
Project Phase:
Pre-Construction, Engineering and Design

Everglades Agricultural Area Storage Reservoir Project, Phase 1

Project Description:
This project is the first part of the of the Everglades Agricultural Area Storage Reservoir component. It includes two above ground reservoirs with a total storage capacity of approximately 240,000 acre-feet located on land associated with the Talisman Land purchase in the Everglades Agricultural Area. Conveyance capacity increases for the Miami, North New River, Bolles and Cross Canals are also included in the design of this project. The initial design for the reservoir(s) assumed 40,000 acres, divided into two, equally sized compartments with water levels fluctuating up to 6 feet above grade in each compartment. However, actual design and construction of this first phase may result in multiple reservoirs by maximizing the use of the land acquired through the Farm Bill land acquisition agreements which encompasses up to 50,000 acres. This project is located in the Everglades Agricultural Area in western Palm Beach County and Hendry County on lands purchased with Department of Interior Farm Bill funds, with South Florida Water Management District funds, and on lands gained through a series of exchanges for lands being purchased with these funds. The area presently consists of land that is mostly under sugar cane cultivation. Implementation of this project will be consistent with the Farm Bill land acquisition agreements. This project will improve timing of environmental deliveries to the Water Conservation Areas by reducing damaging flood releases from the Everglades Agricultural Area to the Water Conservation Areas, reducing Lake Okeechobee regulatory releases to estuaries, meeting supplemental agricultural irrigation demands, and increasing flood protection within the Everglades Agricultural Area. Compartment 1 of the reservoir would be used to meet Everglades Agricultural Area irrigation demands. The source of water is excess Everglades Agricultural Area runoff. Overflows to Compartment 2 could occur when Compartment 1 reaches capacity and Lake Okeechobee regulatory discharges are not occurring or impending. Compartment 2 would be used to meet environmental demands as a priority, but could supply a portion of Everglades Agricultural Area irrigation demands if environmental demands equal zero. Flows will be delivered to the Water Conservation Areas through Stormwater Treatment Areas 3 and 4. The sources of water are overflow from Compartment 1 and Lake Okeechobee regulatory releases. Compartment 2 will be operated as a dry storage reservoir and discharges made down to 18 inches below ground level.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: WRDA 2000	**Comprehensive Plan Component Designation:** G – Part 1

Project Region:
Everglades Agricultural Areas



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Team Calendar
Glossary of Project Terms

USACE Project Manager:
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SFWMD Project Manager:
no designee at this time

Project Schedule:
Start - 30 Sep 2004
End - 17 Sep 2014

Project Phase:
Pre-Construction, Engineering and Design

Everglades Agricultural Area Storage Reservoir Project, Phase 2

Project Description:
This project is the second part of the Everglades Agricultural Area Storage Reservoir component. It includes an above-ground reservoir with a total storage capacity of approximately 120,000 acre-feet located in the Everglades Agricultural Area in western Palm Beach County. The initial design for the reservoir assumed 20,000 acres, which would make-up the third compartment of the storage the Everglades Agricultural reservoir, with water levels fluctuating up to six feet above grade. The need for this compartment will be determined through more detailed planning and design after Phase 1 is completed. The purpose of this project is to further improve the timing of environmental deliveries to the Water Conservation Areas, including reducing damaging flood releases from the Everglades Agricultural Area to the Water Conservation Areas and reducing Lake Okeechobee regulatory releases to the estuaries. This last increment of storage would be used to meet environmental demands as a priority. The sources of water for this reservoir are overflow from the Phase 1 reservoirs and Lake Okeechobee regulatory releases only during extreme wet events. This project will be operated as a dry storage reservoir and discharges made down to 18 inches below ground level. The project can also be designed to provide a water quality treatment function, augmenting the performance of the Everglades Construction Project and ensuring protection of water quality in the Everglades Protection Area. Design of this project for water quality performance will be based on water quality targets for the Everglades Construction Project and other water quality targets developed to protect designated uses in Everglades Agricultural Area waters.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: Not Currently Authorized	**Comprehensive Plan Component Designation:** G – Part 2
Project Region: Everglades Agricultural Areas	

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Web Administrator

Team Calendar
Glossary of Project Terms

USACE Project Manager:
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SFWMD Project Manager:
no designee at this time

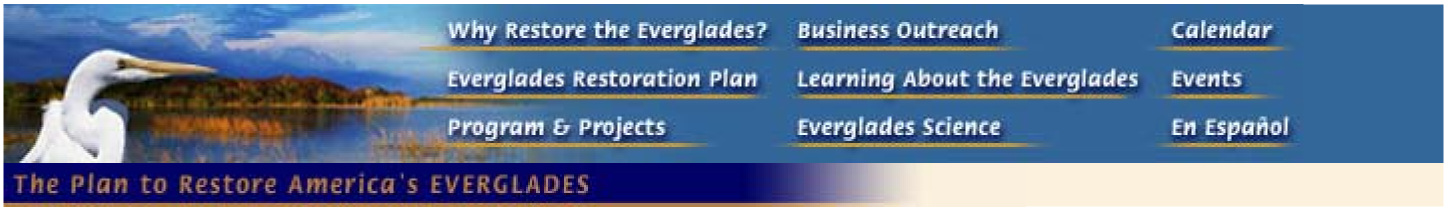
Project Schedule:
Start - 3 Oct 2002
End - 21 Sep 2011

Project Phase:
Pre-Construction, Engineering and Design

Flow to Northwest and Central Water Conservation Area 3A Project

Project Description:
This project includes relocation and modifications to pump stations and development of a spreader canal system located in the northwest corner and west-central portions of Water Conservation Area 3A in western Broward County. The purpose of this project is to increase environmental water supply availability, increase depths and extend wetland hydropatterns in the northwest corner and west-central portions of Water Conservation Area 3A. Additional flows will be directed to the northwest corner and west central portions of Water Conservation Area 3A by increasing the capacity of the G-404 pump station, currently a part of the Everglades Construction Project, and increasing the capacity and relocating the S-140 pump station. A spreader canal system at S-140 will reestablish sheetflow to the west-central portion of Water Conservation Area 3A. Water quality treatment of flows is assumed to be provided by the Everglades Construction Project and water quality treatment strategies developed to fulfill the Non-Everglades Construction Project requirements of the Everglades Forever Act. If additional treatment were determined to be required as a result of future detailed planning and design work, those existing facilities would be modified to provide the necessary treatment.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization:	**Comprehensive Plan Component Designation:** II and RR
Project Region: Everglades, Florida Bay and Keys	



USACE Project Manager:
Paul Moczynski
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SFWMD Project Manager:
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Project Schedule:
Start - 2 Apr 2001
End - 14 Mar 2014

Project Phase:
Pre-Construction, Engineering and Design

North Palm Beach County Project, Part 1

Project Description:
This project includes six separable elements including Pal-Mar and J.W. Corbett Wildlife Management Area Hydropattern Restoration, L-8 Basin Modifications, C-51 and L-8 Reservoir, Lake Worth Lagoon Restoration, C-17 Backpumping and Treatment, and C-51 Backpumping and Treatment. These separable elements have been combined into a single project to address the interdependencies and tradeoffs between the different elements and provide a more efficient and effective design of the overall project. a) Pal-Mar and J.W. Corbett Wildlife Management Area Hydropattern Restoration Other Project Element (OPE). This separable element will consider improvements such as new or modified water control structures, canal modifications and the acquisition of 3,000 acres located between Pal-Mar and the J.W. Corbett Wildlife Management Area in Palm Beach County. The purpose of this separable element, described in the CERP, is to provide hydrologic connections between the J. W. Corbett Wildlife Management Area and: (1) the Moss Property, (2) the C-18 Canal, (3) the Indian Trail Improvement District, and (4) the L-8 Borrow Canal, in addition to extending the spatial extent of protected natural areas. These connections would reduce detrimental effects due to over inundation on native vegetation frequently experienced during the wet season and extend the footprint of the contiguous greenbelt to 126,000-acres. This greenbelt extends from the Dupuis Reserve near Lake Okeechobee across the J.W. Corbett Wildlife Management Area and south to Jonathan Dickinson State Park. b) L-8 Basin Modifications (K - Part 1). This separable element involves modifications to the L-8 Basin including a series of pumps, water control structures, and canal capacity improvements in the M canal. The purpose of this project is to construct the required conveyance to make the C-51 and L-8 Reservoir (see below) functional and thereby increase water supply availability while maintaining or enhancing flood protection for northern Palm Beach County areas. This component will also provide conveyances necessary to deliver flows required to enhance hydroperiods in the Loxahatchee Slough; increase base flows to the Northwest Fork of the Loxahatchee River, and reduce high discharges to the Lake Worth Lagoon. c) C-51 and L-8 Reservoir (GGG). This separable element includes a combination above ground and in-ground reservoir with a total storage capacity of approximately 48,000 acre-feet located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County. The initial design for the reservoir assumed a 1,800-acre reservoir with 1,200 usable acres with the water level fluctuating from 10 feet above grade to 30 feet below grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design. The purpose of this project is to increase water supply availability, and attenuate discharge to the Lake Worth Lagoon and provide ancillary drainage benefits for northern Palm Beach County areas. It will also provide flows to enhance hydroperiods in the Loxahatchee Slough; increase base flows to the Northwest Fork of the Loxahatchee River, and reduces high discharges to the Lake Worth Lagoon. Water will be pumped into the reservoir from the C-51 Canal and Southern L-8 Borrow Canal during the wet season, or periods when excess water is available, and returned to the C-51 and L-8 during dry

periods. Additional projects will also direct excess water into the West Palm Beach Water Catchment Area (also known as the Grassy Waters Preserve). This component or portions of this component may be implemented under a previous authorization. d) Lake Worth Lagoon Restoration (OPE). This project includes sediment removal in the C-51 Canal and sediment removal or capping within a distance of 2.5 miles downstream of the confluence of the C-51 Canal and the Lake Worth Lagoon. A prototype project will be conducted to determine the feasibility and potential cost of removing and disposing of sediments in the lagoon versus capping them. This project includes the evaluation of sediment traps to reduce future accumulation of sediment. The purpose of this project is to improve water quality and allow for the reestablishment of sea grasses and benthic communities. The elimination of the organically enriched sediment from the C-51 Canal discharge will provide for long term improvements to the Lagoon and enable success for additional habitat restoration and enhancement projects planned by Palm Beach County. e) C-17 Backpumping and Treatment (X). This project includes backpumping facilities and a stormwater treatment area (STA) with a total storage capacity of approximately 2,200 acre-feet located in northeastern Palm Beach County. The design assumes a 550-acre STA with the water level fluctuating up to 4 feet above grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design, and will address appropriate pollution load reduction targets necessary to protect receiving waters (e.g. West Palm Beach Water Catchment Area). The purpose of this project is to increase water supplies to the West Palm Beach Water Catchment Area and Loxahatchee Slough by capturing and storing excess flows currently discharged to the Lake Worth Lagoon from the C-17 Canal. Excess C-17 Canal water will be backpumped through existing canals and proposed water control structures to the STA which will provide water quality treatment prior to discharge into the West Palm Beach Water Catchment Area. f) C-51 Backpumping and Treatment (Y). This project includes back-pumping facilities and an STA with a total storage capacity of approximately 2,400 acre-feet located in Palm Beach County. The design includes a 600-acre STA with the water level fluctuating up to 4 feet above grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design, and will address appropriate pollution load reduction targets necessary to protect receiving waters (e.g. West Palm Beach Water Catchment Area). The purpose of this project is to increase water supplies to the West Palm Beach Water Catchment Area and Loxahatchee Slough by capturing and storing excess flows currently discharged to the Lake Worth Lagoon from the C-51 Canal. The conceptual design allows excess C-51 Canal water to be backpumped through existing and proposed water control structures and canals to the STA. The STA will provide water quality treatment prior to discharge into the West Palm Beach Water Catchment Area.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: Not Currently Authorized	**Comprehensive Plan Component Designation:** X, Y, GGG, Pal Mar, LWL, KPh1
Project Region: Northern Palm Beach County	

USACE Project Manager:
no designee at this time

SFWMD Project Manager:
no designee at this time

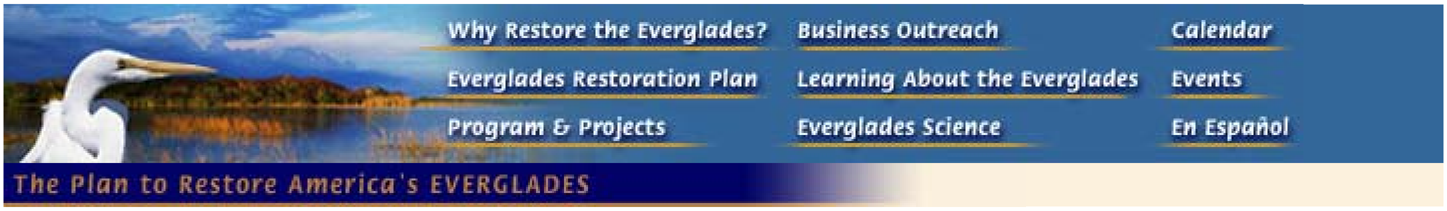
Project Schedule:
Start - 1 May 2009
End - 15 Oct 2020

Project Phase:
Pre-Construction, Engineering and Design

North Palm Beach County Project, Part 2

Project Description:
This project includes two separable elements. The C-51 Regional Groundwater Aquifer Storage and Recovery (ASR) system and L-8 Basin ASR system. These projects will provide additional long-term storage within the North Palm Beach County region. a) C-51 Regional Groundwater Aquifer Storage and Recovery (LL). This project includes a series of ASR wells with a total capacity of 170 million gallons per day, associated pre- and post- water quality treatment to be constructed along the C-51 Canal, and canals that can receive water from the C-51 Canal. The conceptual design assumes 34 well clusters, each with an individual capacity of 5 million gallons per day fed by a combination of vertical and horizontal wells located near existing canals. The conceptual design includes disinfection pre-treatment and post storage aeration. The level and extent of treatment and number of the ASR wells may be modified based on findings from a proposed ASR pilot project. The purpose of this project is to capture and store excess flows from the C-51 Canal, currently discharged to the Lake Worth Lagoon, for later use during dry periods. The ASR facilities will be used to inject and store surficial aquifer ground water adjacent to the C-51 Canal into the upper Floridan Aquifer instead of discharging the canal water to tide. Water will be returned to the C-51 Canal to help maintain canal stages during the dry-season. If water is not available in the ASR system, existing rules for water delivery to this region will be applied. b) L-8 Basin ASR (K - Part 2). This separable element includes ASR wells with a total capacity of 50 million gallons per day and associated pre- and post- water quality treatment to be constructed within the L-8 Basin or along the City of West Palm Beach water supply conveyance and storage system or a combination of both. The conceptual design consists of 10 wells, each with an individual capacity of 5 million gallons per day for a total capacity of 50 million gallons per day. The conceptual design includes disinfection pre-treatment and post storage aeration. The level and extent of treatment and number of the ASR wells may be modified based on findings from a proposed ASR pilot project. The purpose of this project is to increase water supply availability and moderate water level within the West Palm Beach Water Catchment Area. It will also provide flows to enhance hydroperiods in the Loxahatchee Slough; increase base flows to the Northwest Fork of the Loxahatchee River, and reduces high discharges to the Lake Worth Lagoon. During periods when the West Palm Beach Water Catchment Area is above desirable stages, 50 million gallons per day will be diverted for storage in the ASR wells.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: Not Currently Authorized	**Comprehensive Plan Component Designation:** LL, K - Part 2
Project Region: Northern Palm Beach County	



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- Team Calendar
- Glossary of Project Terms

USACE Project Manager:
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SFWMD Project Manager:
Steve Smith
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Project Schedule:
Start - 2 Oct 2003
End - 3 May 2006

Project Phase:
Pre-Construction, Engineering and Design

Modify Rotenberger Wildlife Management Area Operation Plan Project

Project Description:
This project consists of a modification to the current operating plan for Rotenberger Wildlife Management Area to implement rain-driven operations for this area. Water deliveries are made to Rotenberger from Stormwater Treatment Area 5. Discharges from Rotenberger are made to the Holey Land Wildlife Management Area. The deliveries are assumed to be of acceptable water quality. These new operational rules are intended to improve the timing and location of water depths within the Rotenberger Wildlife Management Area.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreement: 12 May 2000	**Project Corporation Agreement:**
Authorization: Not Currently Authorized	**Comprehensive Plan Component Designation:** EE
Project Region: Everglades Agricultural Areas	

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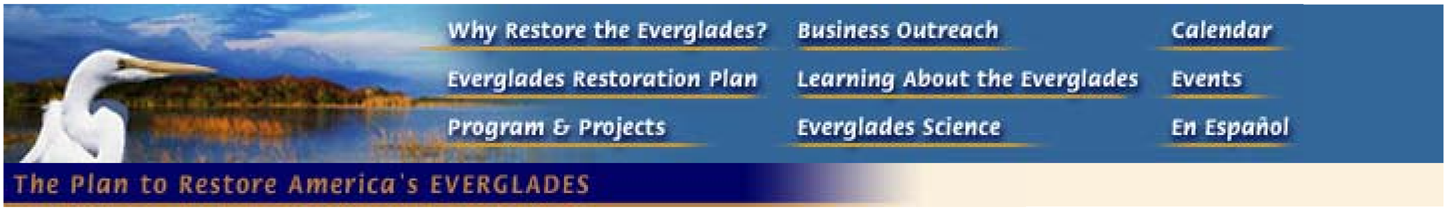

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Team Calendar
Glossary of Project Terms

USACE Project Manager:
Brad Clark
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SFWMD Project Manager:
Steve Smith. Steve Smith
ssmith@sfwmd.gov

Project Schedule:
Start - 2 Oct 2003
End - 26 Mar 2008

Project Phase:
Pre-Construction, Engineering and Design

Modify Holey Land Wildlife Management Area Operation Plan Project

Project Description:
This project consists of a modification to the current operating plan for Holey Land Wildlife Management Area to implement rain-driven operations for this area. Water deliveries are made to Holey Land from the Rotenberger Wildlife Management Area or from Stormwater Treatment Area 3 & 4 if Rotenberger flows are insufficient and the water quality of the deliveries are assumed to be acceptable. These new operational rules are intended to improve the timing and location of water depths within the Holey Land Wildlife Management Area.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: Not Currently Authorized	**Comprehensive Plan Component Designation:** DD
Project Region: Everglades Agricultural Areas	

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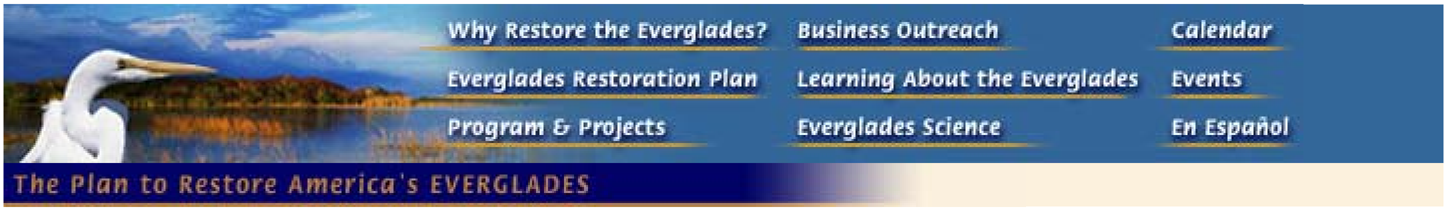

USACE Project Manager:
Doris Marlin
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SFWMD Project Manager:
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Project Schedule:
Start - 30 Jan 2001
End - 4 Oct 2010

Project Phase:
Pre-Construction, Engineering and Design

Water Conservation Area 3 Decompartmentalization and Sheet Flow Enhancement Project, Phase 1

Project Description:
Part 1 of the Water Conservation Area 3 Decompartmentalization and Sheetflow Enhancement Project includes the modification or removal of levees, canals, and water control structures in Water Conservation Area 3A and B located in western Broward County. This project includes backfilling the Miami Canal in Water Conservation Area 3 from one to two miles south of the S-8 pump station down to the East Coast Protective Levee. To make up for the loss of water supply conveyance to the Lower East Coast urban areas from the Miami Canal, the capacity of the North New River Canal within Water Conservation Area 3A will be doubled to convey water supply deliveries to Miami-Dade County as necessary. Modifications will also be made to the eastern section of Tamiami Trail which includes elevating the roadway through the installation of a series of bridges between L-31N Levee and the L-67 Levees. The eastern portion of L-29 Levee and Canal will also be degraded in the same area as the Tamiami Trail modifications. The purpose of this project is to restore sheetflow and reduce unnatural discontinuities in the Everglades landscape. The project includes raising and bridging portions of Tamiami Trail and filling in portions of the Miami Canal within Water Conservation Area 3. Due to the dependencies of components, this project would be implemented with the Water Preserve Areas Project that would create a bypass for water supply deliveries to Miami Canal using the North New River Canal.

Other Project Details:	
Project Sponsor: South Florida Water Management District	
Design Agreeement: 12 May 2000	**Project Corporation Agreement:**
Authorization: WRDA 2000	**Comprehensive Plan Component Designation:** QQ – Part 1 and SS – Part 2
Project Region: Everglades, Florida Bay & Keys	

Appendix B

Preliminary Treatment Performance Estimates

South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-3/4
December 31, 2001

Parameter Description	Unit	STA-3/4 Baseline	Alternative 1 (EAA Reservoir)	Alt. 2 (No Reservoir)		Alt. 2 (Series Treat. with Res.)	
				STA	SAV	STA	SAV
Average Inflow Concentration (C1)	mg/l	0.088	0.074	0.088	0.050	0.074	0.046
k (first order, area based rate constant)*	m/yr	16.00	16.00	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	660,889	697,200	660,889	571,311	697,200	660,625
Ave. Annual Net Seepage Loss, Supply Canal	ac/ft	70,187	17,184	70,187	0	17,184	0
Ave. Annual Net Inflow Volume	ac/ft	590,702	680,016	590,702	571,311	680,016	660,625
	cu.m.	728,624,136	838,791,929	728,624,136	704,705,014	838,791,929	814,872,808
Ave. Annual Rainfall (R)	in	50.8	50.8	50.8	50.8	50.8	50.8
	m	1.290	1.290	1.290	1.290	1.290	1.290
Ave. Annual Potential Evapotranspiration (ET)	in	57.1	57.1	57.1	57.1	57.1	57.1
	m	1.450	1.450	1.450	1.450	1.450	1.450
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.6	0.6	0.6	0.6	0.6	0.6
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	16,653	16,653	7,777	8,876	7,777	8,876
	sq. m	67,392,569	67,392,569	31,472,528	35,920,041	31,472,528	35,920,041
Alpha		-0.760	-0.760	-0.760	-0.760	-0.760	-0.760
Gamma		15.840	15.840	15.840	35.840	15.840	35.840
r		-20.842	-20.842	-20.842	-47.158	-20.842	-47.158
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	10.812	12.446	23.151	19.619	26.652	22.686
Outflow Concentration (C2)	mg/l	0.029	0.029	0.050	0.018	0.046	0.019
	ppb	**29**	**29**	50	**18**	46	**19**
Average Annual Outflow Volume	cu.m.	677,405,783	787,573,577	704,705,014	677,405,783	814,872,808	787,573,577
	ac-ft	**549,179**	**638,493**	571,311	**549,179**	660,625	**638,493**

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-3/4
December 31, 2001

Parameter Description	Unit	Alt. 3	Alt. 4 (Series Treatment, Expanded, with Res.)			Alt. 5 (Series Treatment, Expanded, with Res.)			Alt. 6, Distributed Reservoir	
		(Expansion)	STA	SAV	Expansion	STA	SAV	Expansion	STA	SAV
Average Inflow Concentration (C1)	mg/l	0.074	0.074	0.046	0.019	0.074	0.039	0.074	0.074	0.040
k (first order, area based rate constant)*	m/yr	16.00	16.00	36.00	16.00	16.00	36.00	16.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	697,200	697,200	660,500	638,493	697,200	480,296		537,200	500,500
Ave. Annual Net Seepage Loss, Supply Canal	ac/ft	17,184	17,184	0	0	17,184	0		17,184	0
Ave. Annual Net Inflow Volume	ac/ft	680,016	680,016	660,500	638,493	499,812	480,296	180,204	520,016	500,500
	cu.m.	838,791,929	838,791,929	814,719,027	787,573,577	616,512,068	592,439,166	222,279,861	641,433,766	617,360,864
Ave. Annual Rainfall (R)	in	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8
	m	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290
Ave. Annual Potential Evapotranspiration (ET)	in	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
	m	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	37,000	7,827	8,826	10,000	7,827	8,826	9,800	7,827	8,826
	sq. m	149,734,286	31,674,872	35,717,698	40,468,726	31,674,872	35,717,698	39,659,351	31,674,872	35,717,698
Alpha		-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760
Gamma		15.840	15.840	35.840	15.840	15.840	35.840	15.840	15.840	35.840
r		-20.842	-20.842	-47.158	-20.842	-20.842	-47.158	-20.842	-20.842	-47.158
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	5.602	26.481	22.810	19.461	19.464	16.587	5.605	20.251	17.284
Outflow Concentration (C2)	mg/l	0.015	0.046	0.019	0.015	0.039	0.015	0.015	0.040	0.015
	ppb	**15**	46	19	**15**	39	**15**	**15**	40	**15**
Average Annual Outflow Volume	cu.m.	724,993,872	814,719,027	787,573,577	756,817,345	592,439,166	565,293,715	192,138,754	617,360,864	590,215,413
	ac-ft	**587,759**	660,500	638,493	**613,558**	480,296	**458,289**	**155,769**	500,500	**478,493**

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-5 and STA-6
December 31, 2001

Parameter Description	**Unit**	**STA-5**	**STA-6**	**Alt. 1 (EAA Reservoir), Case 1**		**Alt. 1 (EAA Reservoir), Case 2**		**Alt. 2 (Optimize Treatment, without Reservoir), Case 1**			
		Baseline	**Baseline**	**STA-5**	**STA-6**	**STA-5**	**STA-6**	**STA-5, STA**	**STA-5, SAV**	**STA-6, STA**	**STA-6, SAV**
Average Inflow Concentration (C1)	mg/l	0.192	0.143	0.100	0.100	0.100	0.100	0.192	0.080	0.157	0.059
k (first order, area based rate constant)*	m/yr	16.00	16.00	16.00	16.00	16.00	16.00	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	91,400	58,170	91,183	19,302	73,285	40,690	91,400	87,236	43,770	41,459
	cu.m.	112,740,851	71,752,027	112,473,693	23,808,300	90,396,764	50,191,099	112,740,851	107,604,560	53,989,793	51,138,690
Ave. Annual Rainfall (R)	in	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8
	m	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290
Ave. Annual Potential Evapotranspiration (ET)	in	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
	m	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	4,110	2,282	4,110	870	4,110	2,282	1,670	2,440	927	1,355
	sq. m	16,632,646	9,234,963	16,632,646	3,520,779	16,632,646	9,234,963	6,758,277	9,874,369	3,751,451	5,483,512
Alpha		-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760
Gamma		15.840	15.840	15.840	15.840	15.840	15.840	15.840	35.840	15.840	35.840
r		-20.842	-20.842	-20.842	-20.842	-20.842	-20.842	-20.842	-47.158	-20.842	-47.158
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	6.778	7.770	6.762	6.762	5.435	5.435	16.682	10.897	14.392	9.326
Outflow Concentration (C2)	mg/l	0.027	0.027	0.019	0.019	0.016	0.016	0.080	0.014	0.059	0.013
	ppb	**27**	**27**	**19**	**19**	**16**	**16**	80	**14**	59	**13**
Average Annual Outflow Volume	cu.m.	100,100,039	64,733,455	99,832,882	21,132,508	77,755,953	43,172,527	107,604,560	100,100,039	51,138,690	46,971,220
	ac-ft	**81,152**	**52,480**	**80,935**	**17,132**	**63,037**	**35,000**	87,236	**81,152**	41,459	**38,080**

South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-5 and STA-6, Alternative 1 Flow Equalization Basin
December 31, 2001

ESTIMATED INFLOWS TO FEB	**Estimated Average Annual Inflow by Source**					
	C-139 Basin		**C-139 Annex**		**EAA and Lake**	
	Units	**Value**	**Units**	**Value**	**Units**	**Value**
Average Annual Inflow Volume	ac-ft	122,530	ac-ft	12,640	ac-ft	0
Average Annual Inflow TP Load	kg	29,077	kg	1,090	kg	0
Flow-weighted mean inflow concentration	mg/l	0.192	mg/l	0.07	mg/l	0.000
Total Inflows to FEB						
Average Annual Inflow Volume					ac-ft	135,170
Average Annual Inflow TP Load					kg	30,167
Flow-weighted mean inflow concentration					mg/l	0.181

Approx. Basin Area Available (acres)						**9,900**
Approx. Basin Area Available (sq.m.)						**40,064,013**
ESTIMATED TREATMENT IN BASIN, Case 1	(Analyze as for reservoir per Walker 1987)					
Input Parameters			**Estimated TP Removal**			
Average Inlet Concentration	mg/l	0.181	q	4.002	m/yr	
Average Annual Inflow Volume	ac/ft	135,170	K	0.039		
Average Annual Inflow Volume	cu.m.	166,730,643	P	197.822	ppb	
Average Annual Rainfall	m	1.290	N	1.944	1 m depth at mean outflow	
Average Annual Evapotranspiration	m	1.450		2.962		
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.495		
Infiltration from Groundwater	m/yr	0.000	Pout	100	ppb	
Exfiltration to Groundwater	m/yr	0.600	Pout	0.100	mg/l	
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detention Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987		
Ave. TP Conc. In Seepage Inflows	mg/l	0.000				
Wet Period Fraction		1.00				
SUMMARY OF RESULTS						
Flow Equalization Basin Area	acres	9,900				
Ave. Annual Outflow Volume	cu.m.	136,281,993				
Ave. Annual Outflow Volume	ac-ft	110,485				
Mean TP Conc. In Outflows	mg/l	0.100				

Approx. Basin Area Available (acres)						**8,500**
Approx. Basin Area Available (sq.m.)						**34,398,395**
ESTIMATED TREATMENT IN BASIN, Case 2	(Analyze as for reservoir per Walker 1987)					
Input Parameters			**Estimated TP Removal**			
Average Inlet Concentration	mg/l	0.181	q	4.687	m/yr	
Average Annual Inflow Volume	ac/ft	135,170	K	0.044		
Average Annual Inflow Volume	cu.m.	166,730,643	P	195.350	ppb	
Average Annual Rainfall	m	1.290	N	1.846	1 m depth at mean outflow	
Average Annual Evapotranspiration	m	1.450		2.896		
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.487		
Infiltration from Groundwater	m/yr	0.000	Pout	100	ppb	
Exfiltration to Groundwater	m/yr	0.600	Pout	0.100	mg/l	
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detention Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987		
Ave. TP Conc. In Seepage Inflows	mg/l	0.000				
Wet Period Fraction		1.00				
SUMMARY OF RESULTS						
Flow Equalization Basin Area	acres	8,500				
Ave. Annual Outflow Volume	cu.m.	140,587,863				
Ave. Annual Outflow Volume	ac-ft	113,976				
Mean TP Conc. In Outflows	mg/l	0.100				

South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
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STA-5 and STA-6
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Parameter Description	**Unit**	**Alt. 2 (Optimize Treatment, with Reservoir), Case 2**				**Alt. 3, STA-5 Expansion**		**Alt. 4 (EAA Western Reservoir as FEB)**			
		STA-5, STA	**STA-5, SAV**	**STA-6, STA**	**STA-6, SAV**	**STA-5, STA**	**STA-5, SAV**	**STA-5, STA**	**STA-5, SAV**	**STA-6, STA**	**STA-6, SAV**
Average Inflow Concentration (C1)	mg/l	0.100	0.038	0.100	0.040	0.192	0.048	0.085	0.048	0.085	0.048
k (first order, area based rate constant)*	m/yr	16.00	36.00	16.00	36.00	16.00	36.00	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	73,285	69,121	43,770	41,459	91,400	84,593	124,221	120,132	79,755	77,116
	cu.m.	90,396,764	85,260,474	53,989,793	51,138,690	112,740,851	104,344,399	153,225,514	148,181,492	98,376,315	95,122,306
Ave. Annual Rainfall (R)	in	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8
	m	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290
Ave. Annual Potential Evapotranspiration (ET)	in	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
	m	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	1,670	2,440	927	1,355	2,730	2,440	1,640	2,390	1,058	1,524
	sq. m	6,758,277	9,874,369	3,751,451	5,483,512	11,047,962	9,874,369	6,636,871	9,672,026	4,281,591	6,167,434
Alpha		-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760	-0.760
Gamma		15.840	35.840	15.840	35.840	15.840	35.840	15.840	35.840	15.840	35.840
r		-20.842	-47.158	-20.842	-47.158	-20.842	-47.158	-20.842	-47.158	-20.842	-47.158
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	13.376	8.635	14.392	9.326	10.205	10.567	23.087	15.321	22.977	15.423
Outflow Concentration (C2)	mg/l	0.038	0.012	0.040	0.013	0.048	0.013	0.048	0.015	0.048	0.015
	ppb	38	**12**	40	**13**	48	**13**	48	**15**	48	**15**
Average Annual Outflow Volume	cu.m.	85,260,474	77,755,953	51,138,690	46,971,220	104,344,399	96,839,879	148,181,492	140,830,753	95,122,306	90,435,056
	ac-ft	69,121	**63,037**	41,459	**38,080**	84,593	**78,509**	120,132	**114,173**	77,116	**73,316**

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-5 and STA-6, Alternative 4, Flow Equalization Basin
December 31, 2001

ESTIMATED INFLOWS TO FEB	**Estimated Average Annual Inflow by Source**					
	C-139 Basin		**C-139 Annex**		**Lake Release to Miami**	
	Units	**Value**	**Units**	**Value**	**Units**	**Value**
Average Annual Inflow Volume	ac-ft	122,530	ac-ft	12,640	ac-ft	90,000
Average Annual Inflow TP Load	kg	29,077	kg	1,090	kg	7,439
Flow-weighted mean inflow concentration	mg/l	0.192	mg/l	0.07	mg/l	0.067
Total Inflows to FEB						
Average Annual Inflow Volume					ac-ft	225,170
Average Annual Inflow TP Load					kg	37,606
Flow-weighted mean inflow concentration					mg/l	0.135

Approx. Basin Area Available (acres)					**8,500**
Approx. Basin Area Available (sq.m.)					**34,398,395**
ESTIMATED TREATMENT IN BASIN	(Analyze as for reservoir per Walker 1987)				
Input Parameters			**Estimated TP Removal**		
Average Inlet Concentration	mg/l	0.135	q	7.914	m/yr
Average Annual Inflow Volume	ac/ft	225,170	K	0.063	
Average Annual Inflow Volume	cu.m.	277,744,610	P	143.012	ppb
Average Annual Rainfall	m	1.290	N	1.146	1 m depth at mean outflow
Average Annual Evapotranspiration	m	1.450		2.363	
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.405	
Infiltration from Groundwater	m/yr	0.000	Pout	85	ppb
Exfiltration to Groundwater	m/yr	0.600	Pout	0.085	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detention Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			
SUMMARY OF RESULTS					
Flow Equalization Basin Area	acres	8,500			
Ave. Annual Outflow Volume	cu.m.	251,601,830			
Ave. Annual Outflow Volume	ac-ft	203,976			
Mean TP Conc. In Outflows	mg/l	0.085			

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Parameter Description	Unit	STA-2	Alternative 1	Alt. 2 (With Reservoir)		Alt. 2 (No Reservoir)	
		Baseline	EAA Reservoir	STA	SAV	STA	SAV
Average Inflow Concentration (C1)	mg/l	0.100	0.067	0.067	0.046	0.100	0.061
k (first order, area based rate constant)*	m/yr	16.00	16.00	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	233,473	281,032	281,032	274,624	233,473	227,065
	cu.m.	287,986,265	346,649,871	346,649,871	338,745,519	287,986,265	280,081,914
Ave. Annual Rainfall (R)	in	50.8	50.8	50.8	50.8	50.8	50.8
	m	1.290	1.290	1.290	1.290	1.290	1.290
Ave. Annual Potential Evapotranspiration (ET)	in	57.1	57.1	57.1	57.1	57.1	57.1
	m	1.450	1.450	1.450	1.450	1.450	1.450
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.6	0.6	0.6	0.6	0.6	0.6
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	6,430	6,430	2,570	3,860	2,570	3,860
	sq. m	26,021,391	26,021,391	10,400,463	15,620,928	10,400,463	15,620,928
Alpha		-0.760	-0.760	-0.760	-0.760	-0.760	-0.760
Gamma		15.840	15.840	15.840	35.840	15.840	35.840
r		-20.842	-20.842	-20.842	-47.158	-20.842	-47.158
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	11.067	13.322	33.330	21.685	27.690	17.930
Outflow Concentration (C2)	mg/l	0.032	0.028	0.046	0.018	0.061	0.018
	ppb	**32**	**28**	46	**18**	61	**18**
Average Annual Outflow Volume	cu.m.	268,210,008	326,873,614	338,745,519	326,873,614	280,081,914	268,210,008
	ac-ft	**217,440**	**264,999**	274,624	**264,999**	227,065	**217,440**

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-2, Alternative 1 flow Equalization Basin
December 31, 2001

ESTIMATED INFLOWS TO FEB	**Estimated Average Annual Inflow by Source**					
	S-6/S-2 Basin		**Lake Release to NNR**			
	Units	**Value**	**Units**	**Value**		
Average Annual Inflow Volume	ac-ft	233,473	ac-ft	70,000		
Average Annual Inflow TP Load	kg	29,077	kg	6,390		
Flow-weighted mean inflow concentration	mg/l	0.100	mg/l	0.074		
Total Inflows to FEB						
Average Annual Inflow Volume					ac-ft	303,473
Average Annual Inflow TP Load					kg	35,467
Flow-weighted mean inflow concentration					mg/l	0.095

Approx. Basin Area Available (acres)						**9,000**
Approx. Basin Area Available (sq.m.)						**36,421,830**
ESTIMATED TREATMENT IN BASIN	(Analyze as for reservoir per Walker 1987)					
Input Parameters			**Estimated TP Removal**			
Average Inlet Concentration	mg/l	0.095	q	10.118	m/yr	
Average Annual Inflow Volume	ac/ft	303,473	K	0.073		
Average Annual Inflow Volume	cu.m.	374,330,462	P	100.063	ppb	
Average Annual Rainfall	m	1.290	N	0.726	1 m depth at mean outflow	
Average Annual Evapotranspiration	m	1.450		1.976		
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.328		
Infiltration from Groundwater	m/yr	0.000	Pout	67	ppb	
Exfiltration to Groundwater	m/yr	0.600	Pout	0.067	mg/l	
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detention Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987		
Ave. TP Conc. In Seepage Inflows	mg/l	0.000				
Wet Period Fraction		1.00				
SUMMARY OF RESULTS						
Flow Equalization Basin Area	acres	9,000				
Ave. Annual Outflow Volume	cu.m.	346,649,871				
Ave. Annual Outflow Volume	ac-ft	281,032				
Mean TP Conc. In Outflows	mg/l	0.067				

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-1E Distribution Cell Performance
December 31, 2001

ESTIMATED INFLOWS TO FEB	**Estimated Average Annual Inflow**					
	Baseline & Alt. 2		**Acme Basin B**		**Alternative 4, Case 1**	
	Units	**Value**	**Units**	**Value**	**Units**	**Value**
Average Annual Inflow Volume	ac-ft	133,473	ac-ft	31,499	ac-ft	164,972
Average Annual Inflow TP Load	kg	28,950	kg	3,660	kg	32,610
Flow-weighted mean inflow concentration	mg/l	0.176	mg/l	0.094	mg/l	0.160
	Alternative 4, Case 2					
Average Annual Inflow Volume	ac-ft	142,420				
Average Annual Inflow TP Load	kg	28,907				
Flow-weighted mean inflow concentration	mg/l	0.165				

Approx. Basin Area Available (acres)	**1,046**
Approx. Basin Area Available (sq.m.)	**4,233,026**

ESTIMATED TREATMENT IN BASIN (Baseline)	(Analyze as for reservoir per Walker 1987)				
Input Parameters			**Estimated TP Removal**		
Average Inlet Concentration	mg/l	0.176	q	39.264	m/yr
Average Annual Inflow Volume	ac/ft	133,473	K	0.127	
Average Annual Inflow Volume	cu.m.	164,637,413	P	175.488	ppb
Average Annual Rainfall	m	1.500	N	0.568	1 m depth at mean outflow
Average Annual Evapotranspiration	m	1.130		1.808	
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.288	
Infiltration from Groundwater	m/yr	0.000	Pout	125	ppb
Exfiltration to Groundwater	m/yr	0.100	Pout	0.125	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detetion Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			
SUMMARY OF RESULTS					
Flow Equalization Basin Area	acres	1,046			
Ave. Annual Outflow Volume	cu.m.	165,780,330			
Ave. Annual Outflow Volume	ac-ft	134,400			
Mean TP Conc. In Outflows	mg/l	0.125			

ESTIMATED TREATMENT IN BASIN (Alt. 4, Case 1)		(Analyze as for reservoir per Walker 1987)			
Input Parameters			**Estimated TP Removal**		
Average Inlet Concentration	mg/l	0.160	q	48.172	m/yr
Average Annual Inflow Volume	ac/ft	164,972	K	0.133	
Average Annual Inflow Volume	cu.m.	203,491,068	P	160.841	ppb
Average Annual Rainfall	m	1.500	N	0.445	1 m depth at mean outflow
Average Annual Evapotranspiration	m	1.130		1.667	
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.250	
Infiltration from Groundwater	m/yr	0.000	Pout	121	ppb
Exfiltration to Groundwater	m/yr	0.100	Pout	0.121	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detetion Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			
SUMMARY OF RESULTS					
Flow Equalization Basin Area	acres	1,046			
Ave. Annual Outflow Volume	cu.m.	203,491,068			
Ave. Annual Outflow Volume	ac-ft	164,972			
Mean TP Conc. In Outflows	mg/l	0.121			

ESTIMATED TREATMENT IN BASIN (Alt. 4, Case 2)		(Analyze as for reservoir per Walker 1987)			
Input Parameters			**Estimated TP Removal**		
Average Inlet Concentration	mg/l	0.165	q	41.601	m/yr
Average Annual Inflow Volume	ac/ft	142,420	K	0.129	
Average Annual Inflow Volume	cu.m.	175,673,435	P	165.222	ppb
Average Annual Rainfall	m	1.500	N	0.512	1 m depth at mean outflow
Average Annual Evapotranspiration	m	1.130		1.745	
Average TP Conc. In Rainfall (wet+dry)	mg/l	0.03	R	0.272	
Infiltration from Groundwater	m/yr	0.000	Pout	120	ppb
Exfiltration to Groundwater	m/yr	0.100	Pout	0.120	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detetion Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			
SUMMARY OF RESULTS					
Flow Equalization Basin Area	acres	1,046			
Ave. Annual Outflow Volume	cu.m.	175,673,435			
Ave. Annual Outflow Volume	ac-ft	142,420			
Mean TP Conc. In Outflows	mg/l	0.120			

South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-1E
December 31, 2001

Parameter Description	**Unit**	**STA-1E**	**Alternative 2**		**Alternative 3**		**Alternative 4, Case 1**		**Alternative 4, Case 2**	
		Baseline	**STA**	**SAV**	**STA**	**SAV**	**STA**	**SAV**	**STA**	**SAV**
Average Inflow Concentration (C1)	mg/l	0.125	0.125	0.060	0.125	0.060	0.121	0.066	0.120	0.061
k (first order, area based rate constant)*	m/yr	16.00	16.00	36.00	16.00	36.00	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	134,400	134,400	136,314	134,400	136,314	164,972	166,886	142,420	144,334
	cu.m.	165,780,330	165,780,330	168,141,268	165,780,330	168,141,268	203,491,068	205,852,006	175,673,435	178,034,373
Ave. Annual Rainfall (R)	in	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1
	m	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501
Ave. Annual Potential Evapotranspiration (ET)	in	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	m	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	5,132	2,134	2,998	2,134	5,350	2,134	4,100	2,134	3,405
	sq. m	20,768,550	8,636,026	12,132,524	8,636,026	21,650,768	8,636,026	16,592,178	8,636,026	13,779,601
Alpha		0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273
Gamma		16.373	16.373	36.373	16.373	36.373	16.373	36.373	16.373	36.373
r		59.892	59.892	133.049	59.892	133.049	59.892	133.049	59.892	133.049
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	7.982	19.196	13.859	19.196	7.766	23.563	12.407	20.342	12.920
Outflow Concentration (C2)	mg/l	0.027	0.060	0.016	0.060	0.012	0.066	0.015	0.061	0.015
	ppb	**27**	60	**16**	60	**12.49**	66	**15.00**	61	**15.00**
Average Annual Outflow Volume	cu.m.	171,458,087	168,141,268	171,458,087	168,141,268	174,060,208	205,852,006	210,388,016	178,034,373	181,801,474
	ac-ft	**139,003**	136,314	**139,003**	136,314	**141,112**	166,886	**170,563**	144,334	**147,388**

South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-1E Alternative 5
December 31, 2001

ESTIMATED INFLOWS TO FEBs	Estimated Average Annual Inflow			
	STA-1E Distribution Cells		100-acre Rock Pit Reservoir	
	Units	Value	Units	Value
Average Annual Inflow Volume	ac-ft	133,331	ac-ft	31,499
Average Annual Inflow TP Load	kg	26,234	kg	6,376
Flow-weighted mean inflow concentratio	mg/l	0.160	mg/l	0.164

Parameter Description	Unit	STA-1E		New STA at Reservoir	
		STA	SAV	STA	SAV
Average Inflow Concentration (C1)	mg/l	0.117	0.057	0.095	0.050
k (first order, area based rate constant)*	m/yr	16.00	36.00	16.00	36.00
Ave. Annual Inflow Volume (Q)	ac/ft	133,420	135,334	31,499	31,910
	cu.m.	164,571,523	166,932,461	38,853,655	39,360,360
Ave. Annual Rainfall (R)	in	59.1	59.1	59.1	59.1
	m	1.501	1.501	1.501	1.501
Ave. Annual Potential Evapotranspiration (ET)	in	44.4	44.4	44.4	44.4
	m	1.128	1.128	1.128	1.128
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.1	0.1	0.1	0.1
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	2,134	2,998	458	687
	sq. m	8,636,026	12,132,524	1,853,468	2,780,201
Alpha		0.273	0.273	0.273	0.273
Gamma		16.373	36.373	16.373	36.373
r		59.892	133.049	59.892	133.049
C*	mg/l	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	19.056	13.759	20.963	14.157
Outflow Concentration (C2)	mg/l	0.057	0.015	0.050	0.015
	ppb	57	**15.2**	50	**15.0**
Average Annual Outflow Volume	cu.m.	166,932,461	170,249,280	39,360,360	40,120,419
	ac-ft	135,334	**138,023**	31,910	**32,526**

Approx. Basin Area Available in STA-1E Distribution Cells (acres)	**1,046**
Approx. Basin Area Available in STA-1E Distribution Cells (sq.m.)	**4,233,026**
Approx. Basin Area Available in Rock Pit Reservoir (acres)	**100**
Approx. Basin Area Available in Rock Pit Reservoir (sq.m.)	**404,687**

ESTIMATED TREATMENT IN STA-1E DISTRIBUTION CELLS (Analyze as for reservoir per Walker 1987)

Input Parameters			Estimated TP Removal		
Average Inlet Concentration	mg/l	0.160	q	38.978	m/yr
Average Annual Inflow Volume	ac/ft	133,331	K	0.127	
Average Annual Inflow Volume	cu.m.	164,462,258	P	160.638	ppb
Average Annual Rainfall	m	1.500	N	0.522	1 m depth at mean outflo
Average Annual Evapotranspiration	m	1.130		1.758	
Average TP Conc. In Rainfall (wet+d	mg/l	0.03	R	0.275	
Infiltration from Groundwater	m/yr	0.000	Pout	117	ppb
Exfiltration to Groundwater	m/yr	0.100	Pout	0.117	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detetion Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			

SUMMARY OF RESULTS

Flow Equalization Basin Area	acres	1,046
Ave. Annual Outflow Volume	cu.m.	164,571,523
Ave. Annual Outflow Volume	ac-ft	133,420
Mean TP Conc. In Outflows	mg/l	0.117

ESTIMATED TREATMENT IN 100-ACRE ROCK PIT (Analyze as for reservoir per Walker 1987)

Input Parameters			Estimated TP Removal		
Average Inlet Concentration	mg/l	0.164	q	96.109	m/yr
Average Annual Inflow Volume	ac/ft	31,499	K	0.149	
Average Annual Inflow Volume	cu.m.	38,853,655	P	164.298	ppb
Average Annual Rainfall	m	1.500	N	1.276	5 m depth at mean outflo
Average Annual Evapotranspiration	m	1.130		2.471	
Average TP Conc. In Rainfall (wet+d	mg/l	0.03	R	0.424	
Infiltration from Groundwater	m/yr	0.000	Pout	95	ppb
Exfiltration to Groundwater	m/yr	0.100	Pout	0.095	mg/l
Change in Storage	cu.m./yr.	0	REF:	*Phosphorus Removal by Urban Runoff Detetion Basins;* Lake and Reservoir Management, Volume 3; North American Lake Management Society; 1987	
Ave. TP Conc. In Seepage Inflows	mg/l	0.000			
Wet Period Fraction		1.00			

SUMMARY OF RESULTS

Flow Equalization Basin Area	acres	100
Ave. Annual Outflow Volume	cu.m.	38,853,655
Ave. Annual Outflow Volume	ac-ft	31,499
Mean TP Conc. In Outflows	mg/l	0.095

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-1W
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Parameter Description	Unit	STA-1W Baseline	STA-1W Alt. 1	STA-1W Alt.2 Cells 5A & 5B STA	Cells 5A & 5B SAV	Cells 2 & 4 STA	Cells 2 & 4 SAV	Cells 1 & 3 STA	Cells 1 & 3 SAV	STA-1W Total
Average Inflow Concentration (C1)	mg/l	0.139	0.139	0.139	0.094	0.139	0.038	0.139	0.046	0.139
k (first order, area based rate constant)*	m/yr	16.00	16.00	16.00	36.00	16.00	36.00	16.00	36.00	25.71
Ave. Annual Inflow Volume (Q)	ac/ft	160,335	157,455	68,623	69,127	31,265	32,109	60,446	61,783	160,335
	cu.m.	197,771,382	194,218,935	84,646,151	85,267,917	38,565,419	39,606,489	74,559,811	76,208,263	197,771,382
Ave. Annual Rainfall (R)	in	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1
	m	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501
Ave. Annual Potential Evapotranspiration (ET)	in	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	m	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	6,670	6,670	562	2,293	941	358	1,490	1,026	6,670
	sq. m	26,992,640	26,992,640	2,274,342	9,279,479	3,808,107	1,448,780	6,029,840	4,152,091	26,992,640
Alpha		0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273
Gamma		16.373	16.373	16.373	36.373	16.373	36.373	16.373	36.373	26.083
r		59.892	59.892	59.892	133.049	59.892	133.049	59.892	133.049	95.410
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	7.327	7.195	37.218	9.189	10.127	27.338	12.365	18.354	7.327
Outflow Concentration (C2)	mg/l	0.026	0.026	0.094	0.014	0.038	0.019	0.046	0.017	0.016
	ppb	**26**	**26**	94	**14**	38	**19**	46	**17**	**15.85**
Average Annual Outflow Volume	cu.m.	205,150,696	201,598,249	85,267,917	87,804,763	39,606,489	40,002,560	76,208,263	77,343,372	205,150,696
	ac-ft	**166,317**	**163,437**	69,127	**71,184**	32,109	**32,430**	61,783	**62,703**	**166,317**

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South Florida Water Management District
Contract C-E023, Basin-Specific Feasibility Studies for ECP Basins
Task 3, Peer Review of Preliminary Alternative Combinations
STA-1W Alternative 3
December 31, 2001

		STA-1W Alt. 3								
Parameter Description	**Unit**	**Cells 5A & 5B**		**Cells 2 & 4**		**Cells 1 & 3**		**Expansion Area**		**STA-1W**
		STA	**SAV**	**STA**	**SAV**	**STA**	**SAV**	**STA**	**SAV**	**Total**
Average Inflow Concentration (C1)	mg/l	0.138	0.091	0.138	0.035	0.138	0.043	0.138	0.061	0.138
k (first order, area based rate constant)*	m/yr	16.00	36.00	16.00	36.00	16.00	36.00	16.00	36.00	25.96
Ave. Annual Inflow Volume (Q)	ac/ft	62,361	62,847	29,457	30,301	57,054	58,391	34,015	34,553	182,887
	cu.m.	76,921,239	77,520,877	36,334,796	37,375,866	70,375,941	72,024,393	41,957,039	42,620,846	225,589,015
Ave. Annual Rainfall (R)	in	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1
	m	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501	1.501
Ave. Annual Potential Evapotranspiration (ET)	in	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	m	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128
Cr - Average TP Conc. In Rainfall (wet+dry)	mg/l	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Infiltration from Groundwater (Ii)	m/yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exfiltration to Groundwater (Io)	m/yr	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Change in Storage (S)	cu.m./yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Internal Loading TP Conc. (Clamda)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TP Conc. In Infiltration from Groundwater (Ci)	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Known Effective Treatment Area	ac	542	2,208	941	358	1,490	1,026	600	900	8,065
	sq. m	2,193,405	8,935,495	3,808,107	1,448,780	6,029,840	4,152,091	2,428,124	3,642,185	32,638,028
Alpha		0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273	0.273
Gamma		16.373	36.373	16.373	36.373	16.373	36.373	16.373	36.373	26.333
r		59.892	133.049	59.892	133.049	59.892	133.049	59.892	133.049	96.324
C*	mg/l	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Hydraulic Loading Rate (q)	m/yr	35.069	8.676	9.541	25.798	11.671	17.347	17.280	11.702	6.912
Outflow Concentration (C2)	mg/l	0.091	0.013	0.035	0.018	0.043	0.016	0.061	0.014	0.015
	ppb	91	**13**	35	**18**	43	**16**	61	**14**	**15.00**
Average Annual Outflow Volume	cu.m.	77,520,877	79,963,685	37,375,866	37,771,937	72,024,393	73,159,502	42,620,846	43,616,555	234,511,679
	ac-ft	62,847	**64,827**	30,301	**30,622**	58,391	**59,311**	34,553	**35,360**	**190,121**

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